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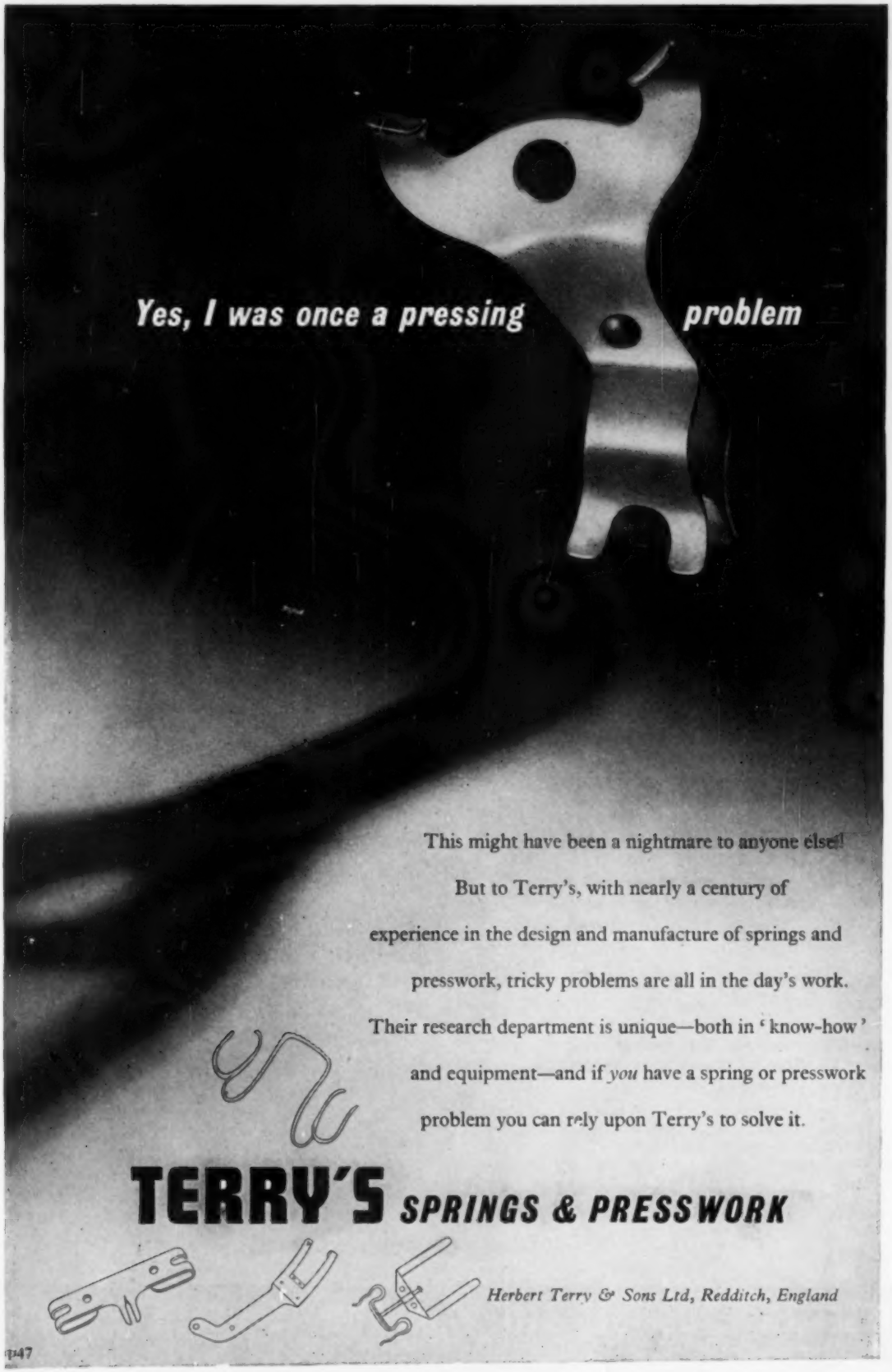
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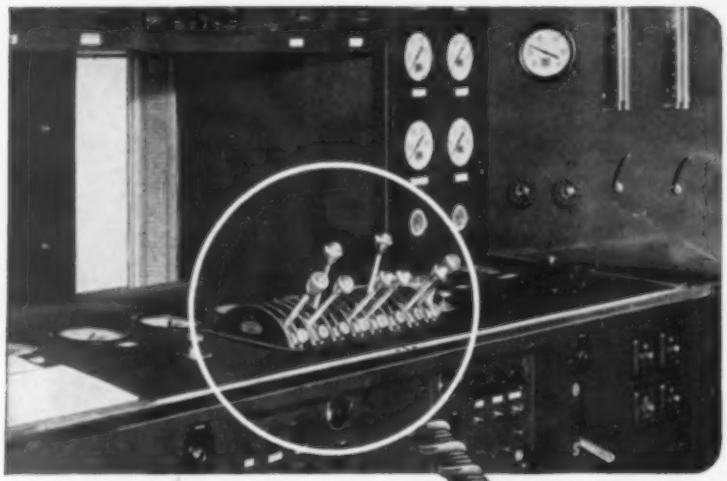

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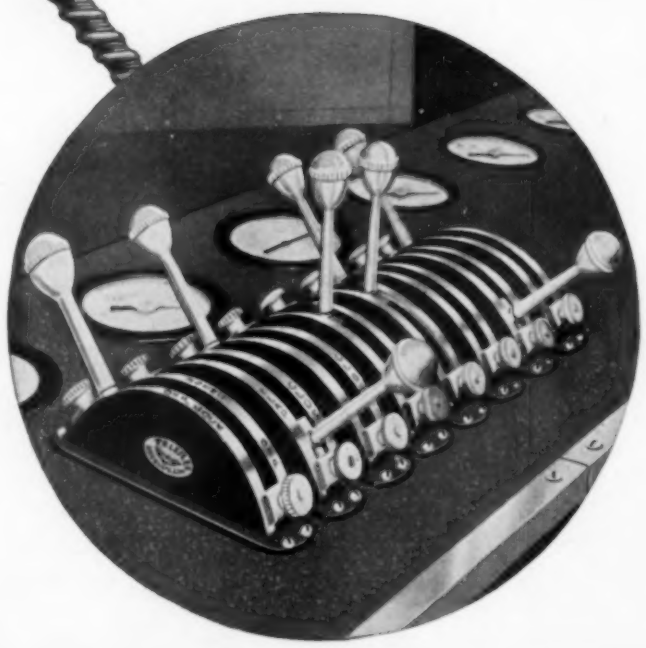

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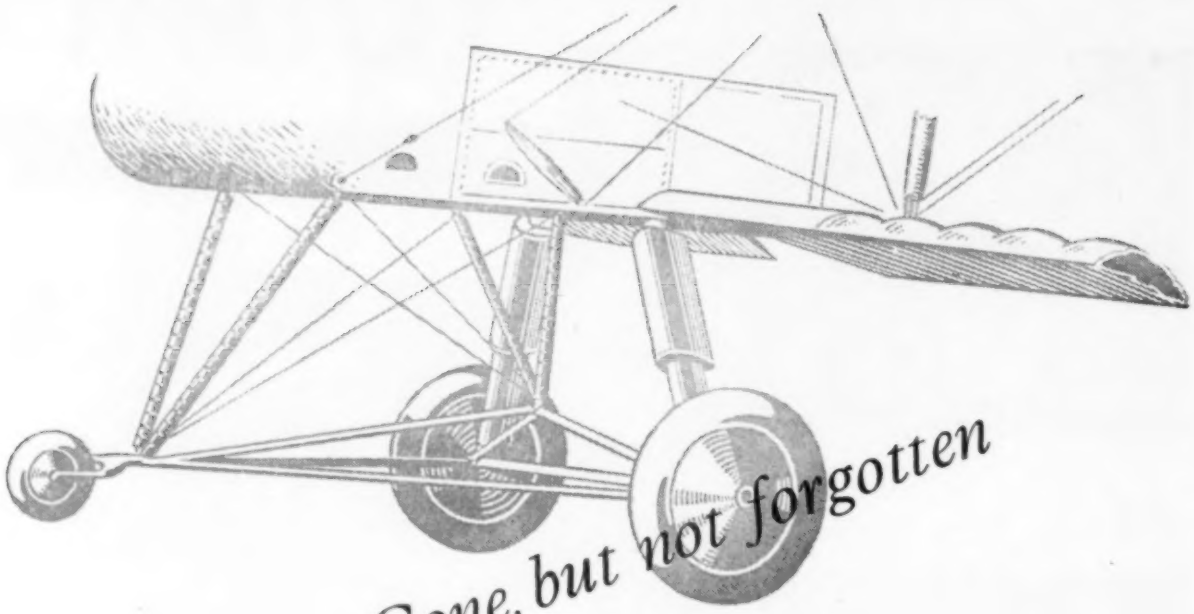

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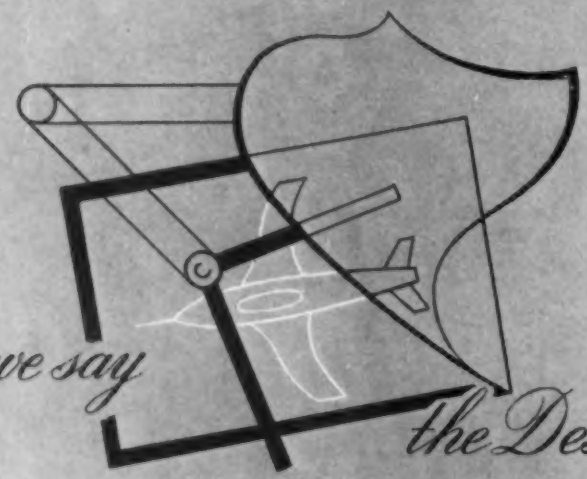

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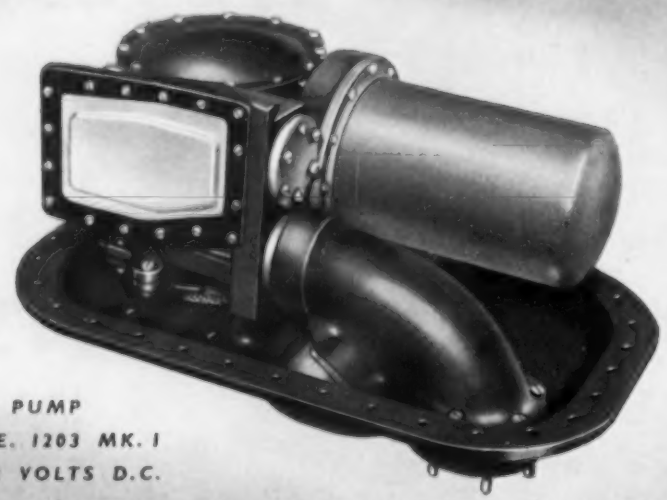

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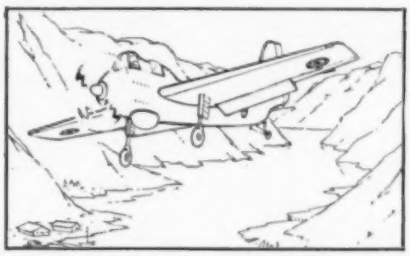

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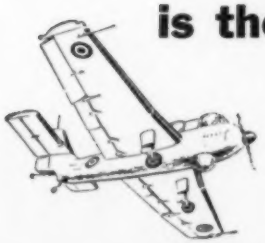

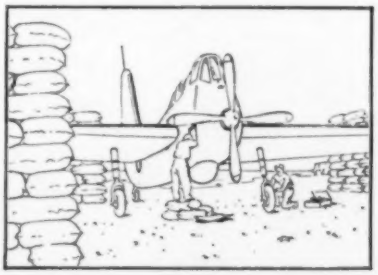

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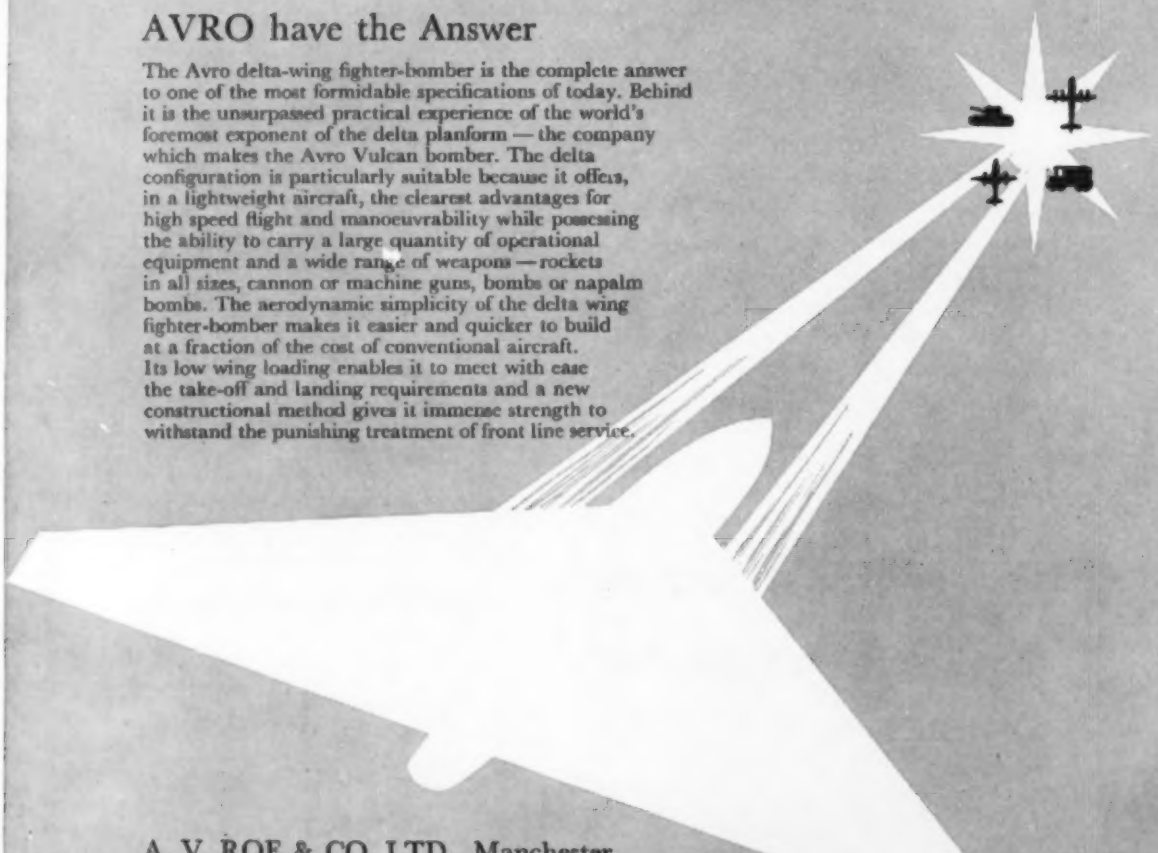

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The Prestige of Air Travel

IN recent weeks we have commented upon several topical aspects of air transport. In particular we have welcomed the increasing public acceptance of the air as an everyday means of travel, and we have discussed the effects of the introduction of "coach" and tourist services. Now, at the risk of appearing to contradict some of our own contentions, we must add that, in certain important respects, air transport does and should differ from all other forms.

Two basic and similar thoughts—even fears—are in our mind: first, that while a cut-price article is not expected to be as good as the expensive luxury version, in the air it must always be just as safe; there is a definite relationship between safety and cost. Secondly, a reduction of quality which in one direction may be quite proper in relation to reduced fares is wholly unacceptable if it overflows in others.

Before amplifying these remarks, let us state at once that they are not barbed or even aimed—except, in some cases perhaps, at the future.

First, some thoughts on safety. In this connection no airline would intentionally lower its standards, but the majority now carry, in given types of aircraft, nearly twice as many passengers as those machines were orignally designed for; and they are carrying them with no increase in the number of normal or emergency exits. Again, there is the matter of size of aircrew. Obviously, to show a profit with really competitive fares an operator wants to save weight and salaries. We do not intend to get involved here in arguments about crew trades and composition, but simply to remark that fatigue—particularly for a captain flying long stages with the responsibility of carrying 50 to 80 passengers where previously there were 20 to 40—may be a factor not yet fully appreciated.

Again, what of the increasing number of young children now conveyed by air? In an emergency, how can mothers or guardians be expected to react if the proportion of babes-in-arms and toddlers is, say, 12 out of 50 total in an aircraft? How does this affect the safety of the children and that of the other passengers?

And this leads us to the second heading, for we have experience of the efforts of a steward and a stewardess to serve food and drink on a long flight to more than 50 tourist passengers while stepping over carry-cots, bags of food, bottles, coats and brief-cases; and all this with eight highly mobile infants running in and out of the narrow aisle. Frankly, such conditions are hardly fair either to the crew or to the other passengers, and a certain tenseness among them confirmed the impression on the particular occasion in mind. Before breakfast-time stops, when everyone wants to freshen-up, shave, scrub babies, and so on, in two or maybe three toilet compartments and with little more than an hour available, the near chaos, even in calm weather, can be imagined.

Minimum standards, whether for safety, comfort, or food, are the responsibility of each individual operator, I.A.T.A. notwithstanding; and those companies whose reputations have to some extent been built up on excellent service stand to lose most.

Finally, and perhaps most important of all, it is only human that when aircrews see lowered standards, whether of space, comfort, meals or service, or among the travellers themselves, they will find it more difficult to maintain their own individual standards. Yet these attributes must be kept at top level at any cost. There are signs of a lowering of personal standards among aircrew on the ground, which if they spread could have nothing but disastrous effects on the quality and eventually the safety of air travel.

Every uniformed member of an aircrew when on duty before, during and after a flight, is in effect an actor on a stage. He gives confidence in his ability or otherwise, and pleases or disappoints. The audience, or passengers, form profound impressions of a good or bad show—and with the important difference that they entrust to the cast not just their entertainment, but their lives. To those who pay for their seats this is no comedy and, it is their heartfelt hope, no tragedy either. This vital matter is in the hands of the principal—the captain of the aircraft—and we respectfully ask such officers if they are entirely satisfied; and if not, what, with the co-operation of the operators, they propose to do about it. It may be added that the operator who does not encourage and act on advice from his aircrews is inviting trouble.

FROM ALL QUARTERS

Air Views in the Lords

IN a debate in the House of Lords last week on the 1954-55 Air Estimates (the Commons Debate took place last March) Lord Douglas of Kirtleside spoke of the suggestions that Britain should leave strategic bombing to the U.S.A.F. He believed that "Britain should do her share in providing the greatest deterrent to world war three—we should not expect the Americans to do our dirty work for us." From this he went on to ask why we should have three types of V-bomber (Valiant, Vulcan and Victor) under development. Such development, he maintained, could become both inefficient and wasteful, and he believed, looking back on the simultaneous development during the war of the Stirling, Halifax, and Manchester, that that was a mistake. He hoped that before it was too late the Air Staff would make up their minds which of the three bombers was the best, and would concentrate production on one, or at the most two, of them.

After going on to criticize delays in getting modern fighters into service, Lord Douglas turned to flying-boats, saying that it seemed a mistake to have stopped their development; something should be set aside next year for the development of a successor to "that grand old aircraft the Sunderland."

Lord Templewood made a plea for an insurance scheme for aircrews, pointing out that at present a widow received a pension varying from 23s a week for a sergeant to £130 a year for a flying officer, or £200 for higher ranks. He went on to quote the U.S.A.F. scheme, under which next-of-kin received a sum consisting of six months' pay and allowances while every man, whatever his rank, was insured for $10,000, which on death was paid at an annual rate of 2½ per cent. The Secretary of State should arrange with the life offices to produce a definite comprehensive insurance, preferably contributory, with sufficient Government aid to bring the contributions within reach of R.A.F. men.

Lord De L'Isle and Dudley, Secretary of State for Air, after references to the new Service pay arrangements, said he would certainly look into the American scheme. [Insurance companies, according to the *Daily Telegraph*, would welcome such a proposal; a spokesman of the Life Offices Association is quoted as saying: "It is entirely up to the Air Ministry. We are prepared to insure the lives of R.A.F. fliers, but extra premiums would be required to cover flying risks. . . ."]

Commenting on Lord Douglas's remarks about V-bombers, the Air Minister said that in the Government's view it was better to continue the development of the three bombers than to decide on only one. The Valiant represented the first stage, and the crescent wing Victor and delta wing Vulcan were later stages in the long-range medium bomber. They were not, therefore, dealing with three different types and a premature decision and a wrong choice might well be disastrous.

Britannia Tropical Trials

TROPICAL trials of the first prototype Britannia are expected to be made at Idris el Awal, Tripoli, next month. Bristol's chief test pilot, "Bill" Pegg, has flown to Tripoli to plan the trials. On Tuesday the aircraft made its first flight after considerable modification to bring it to full production standards; it is now ready to take over some of the duties of the production prototype lost in the forced landing four months ago.

Additional flight-development of Proteus turboprops for Britannias is about to begin at Bristol in the second prototype Ambassador G-AKRD. No photographs of this interesting installation have been made available.

U.K.—U.S. Guided-weapon Co-operation?

LAST Tuesday, the Minister of Supply, Mr. Duncan Sandys, flew to America for high-level talks, particularly with Mr. Charles Wilson, the U.S. Secretary for Defence. It was understood that a principal topic of discussion would be the pooling of the research effort now being conducted in the field of guided weapons by both countries along roughly parallel lines.

The *Sunday Times* last week drew attention to this subject: "Outside the atomic field, which is governed by the restrictions of the McMahon Act, there exists already a fairly free interchange of information about new weapon projects, but that is not active collaboration." The report points out that some military aircraft have distinct civil possibilities, and legitimate commercial interests make co-operation impracticable in such cases. But the guided-weapon field is an outstanding case where duplication of effort by highly skilled men can, and should, be avoided.

It may be noted that, before going to Washington, Mr. Sandys is touring American guided weapon establishments, accompanied by Sir Steuart Mitchell, the M.o.S. Controller of Guided Weapons and Electronics. He has already toured guided weapon establishments in Australia and Canada.

PREMIER AWARD in the Royal Aero Club Trophy Race, to be flown at Baginton, Coventry, on the evening of Friday, June 18th. It is to be won outright, and the winner will also receive £100. Entries for the race—totalling 28—were listed in "Flight" of May 14th, and details of the air displays on June 18th and on the 19th (when the King's Cup Race will be contested) were given on page 704 of last week's issue.

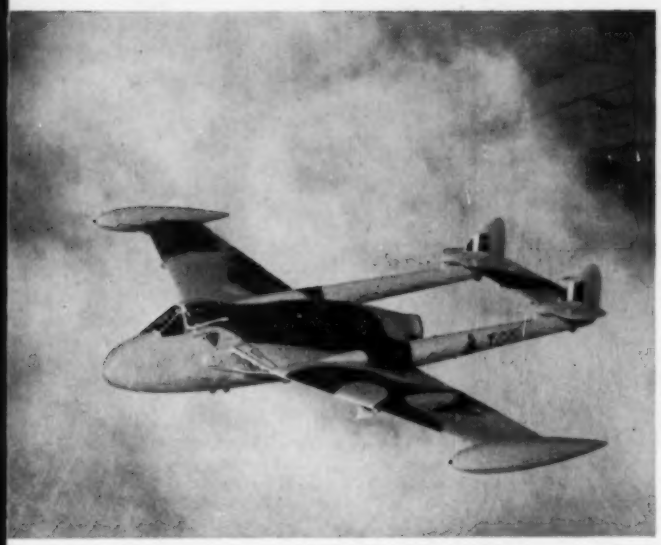
Fire in American Carrier

WHILE steaming from Norfolk, Virginia, to Quonset, Rhode Island, on May 26th, the U.S. carrier *Bennington* was severely damaged by explosions, followed by fire, as a result of which 99 of her training-cruise complement of some 2,300 were killed. The disaster occurred at about 6.20 a.m., when the carrier was 75 miles south of Newport. The first of the ship's air groups (F2H Banshees and F9F Cougars) had just been launched, when a succession of explosions took place forward on the port side, at the second or third deck level.

The resulting fire was not under control until nearly six hours later, and the carrier eventually docked at Quonset soon after noon. During the last 75 miles the ship had been under her own power; the second air group was flown off to clear the deck, and the most critical casualties were evacuated by a shuttle of helicopters, most of which seem to have been Piasecki HUPs. No aircraft were lost.

The inquiry into the disaster opened last Saturday. Evidence was given suggesting that the port catapult may have failed; at least two officers, Cdr. Hanley and the executive officer, Cdr. Avery, testified to the appearance of dense yellowish smoke smelling of highly inflammable hydraulic oil. Capt. Raborn, who had only commanded the ship for a month, said that a radio fault had

MOVING IN: The first helicopter to alight aboard the new aircraft carrier H.M.S. "Centaur" was this trim-looking Westland-Sikorsky Dragonfly (Alvis Leonides). Note, to starboard, the lethal-looking nest of anti-aircraft ordnance, and, soaring above, the radar and other aerials.



DESERT STEED: One of a batch of de Havilland Venom F.B.1s (D.H. Ghost) for the Iraqi Air Force, the first of which was delivered to Iraq by D.H. test pilot G. F. Thornton in a total flying time of 6 hr 25 min. The Iraqis have been using Vampire fighter/bombers for a considerable time and have recently adopted the Vampire Trainer.

developed in an aircraft about to be launched from the starboard catapult, thus throwing the entire flying-off load on to the port installation. He estimated that the first explosion took place 15 seconds after the last machine had left the port catapult. (*Bennington* is not fitted with a steam catapult.)

R.C.A.F. Sabre Supply—

IT has been known for some while that as the Orenda-engined Sabres came into service with the Royal Canadian Air Force the older Mk 4s with American J47 turbojets will be handed over to other NATO air forces (*Flight*, February 26th, 1954). A statement giving details of this disposal has now been made by the Canadian Minister of National Defence, Mr. Brooke Claxton.

In it he says "Canada is steadily replacing Sabre fighters of the R.C.A.F. in Europe with new Sabres being flown over with the very much more powerful Canadian-made Orenda engine. Some of the Sabres to be replaced will be used to build up reserves; others, after complete overhaul, will be made available as Mutual Aid to other North Atlantic Treaty nations.

"Recommendation has been received from the Standing Group of NATO that the first 54 of these aircraft to be released in this way should be allocated to Greece and Turkey with each nation to receive 27 in the first instance. Further deliveries of the aircraft are expected to be completed by this coming autumn. It is expected that the jet fighters will be picked up in the United Kingdom following reconditioning.

"The 54 Sabres will be transferred to Greece and Turkey complete with a new supply of spares, including a spare engine for each fighter. This will be a completely Canadian contribution. After the first year the supply of spares will be maintained as a joint Canadian-U.S. contribution. Canada will provide spares for parts made in Canada and the U.S. will provide the remaining spares, including engine spares.

"Already 400 Mk 2 and 4 Sabres have been provided to the R.A.F. under a similar Canadian-U.S. Mutual Aid programme. These Sabres are equipped with American J47 jet engines."

—and Canadian Planning

ALTHOUGH it is hard at work at present, the virile Canadian aircraft industry is running towards the end of most of its present military contracts, and forward planning is now well advanced to ensure that there will be no "run-down" or recession. Briefly, the position is as follows.

Canadair, Ltd., are approaching the finish of their contracts for Sabres (about 1,200 completed so far) and T-33A-N Silver Star jet trainers, while the $175m order for 50 ocean-reconnaissance Britannia developments is only large enough to occupy a part of the company's capacity. All the indications now point towards licence-production of the F-100 Super Sabre, which should be greatly facilitated by the close liaison that already exists between Canadair and North American Aviation. A Canadian correspondent suggests that, if this were to be agreed, the basic American air-superiority fighter design might be converted to meet Canadian requirements, and that it might eventually appear with "one of the Super Orendas" now being developed by Avro Canada.

Avro Canada themselves are well under way with production to meet the order for 600 CF-100 Mk 4s, with deliveries exceeding 100. "Several squadrons" of earlier versions of these aircraft exist, and, as rocket-armed Mk 4s are delivered, the earlier machines are being transferred to auxiliary units. Following the CF-100 comes the new CF-105 supersonic all-weather machine, the development of which (and its air-to-air missiles) will cost $8m this year. The design study programme for the CF-105 has been completed, and a development contract has been approved for two prototypes; production might begin in 1958-59. The missile is also progressing favourably and initial launchings have been "encouraging."

Other major Canadian purchases include: 100 Grumman S2F anti-submarine aircraft from de Havilland Aircraft of Canada, Ltd.; a trial-quantity of 25 aircraft from the assembly line of Beech T-34 Mentors at the Fort William plant of Canadian Car and Foundry—where large orders for the U.S. Air Force are being speedily executed; direct purchase of 30 McDonnell F2H-4 Banshee fighters for R.C.N. carriers; direct purchase of Fairchild C-119G Packets; direct purchase of six Piasecki H-21 Work-Horse helicopters for the R.C.A.F.; direct purchase of three Piasecki HUP (or H-25A) helicopters for the R.C.N.; and direct purchase of 25 Lockheed P2V-7 Neptunes for the R.C.A.F., pending delivery of the first M.R. Britannia in about three years' time.

Segrave Trophy for Neville Duke

FOR upholding British prestige before the world by obtaining two world air speed records during 1953 S/L. Neville Duke, D.S.O., O.B.E., D.F.C., A.F.C., has been—as already briefly reported in these columns—awarded the Segrave Trophy for 1953. Formal presentation was due to take place last Tuesday evening at the Royal Automobile Club, the Rt. Hon. Lord De L'Isle and Dudley, Secretary of State for Air, officiating.

First awarded in 1930, the trophy was instituted in memory of the late Sir Henry Segrave, and it is presented to the British subject who, in the judgment of the awarding committee, accomplishes the most outstanding demonstration of the possibilities of land, air or water transport. The intention is to stimulate others also to uphold British prestige before the world by demonstrating how the display of courage, initiative and skill can assist progress in mechanical development. The awarding committee comprises representatives of the Institute of Automobile Engineers, the Institute of Mechanical Engineers, the Royal Automobile Club, the Royal Aero Club, the Royal Aeronautical Society, the Marine Motoring Association and the Newspaper Proprietors' Association.

The two records for which Neville Duke receives the trophy were, of course, the world speed record over 3 km (727.6 m.p.h.) and the world's closed-circuit course speed record (709.2 m.p.h.), both made with the Hawker Hunter 1 with Rolls-Royce Avon engine. The dates and places respectively were September 7th at Littlehampton and September 19th from Dunsfold Aerodrome. Previous recipients of the award were as follows:—

1930. A. Cdre. Sir Charles Kingsford-Smith: (a) Atlantic flight and (b) England-Australia flight.
1931. S/L. H. J. L. Hinkler, A.F.C., D.S.M.: Solo flight from New York to London via Trinidad, etc.
1932. Mrs. J. A. Mollison: Flight from England to Cape Town and back.
1933. Capt. Sir Malcolm Campbell, M.B.E.; World's land speed records (car), at Daytona Beach.
1934. K. H. Waller: Flight from Australia to England, and Belgium-Congo-Belgium flight.
1935. Capt. G. E. T. Eyston: Successful attempt on world's land speed records (car), including the hour, and 12 and 24 hours, at Salt Flats, Utah.
1936. Miss Jean Batten: Flight between England and New Zealand.
1937. F/O. A. E. Clouston: Flight from England to South Africa and back.
1938. Maj. A. T. Gardner: For speed records on a 1,100 c.c. car in Germany.
1939. Capt. Sir Malcolm Campbell, M.B.E.: For his world's water speed record on Lake Coniston, when he attained a speed of 141.74 m.p.h.
1940-45. Not awarded.
1946. Geoffrey de Havilland, O.B.E.: For his outstanding work (culminating in a flight on September 27th, 1946, in which he lost his life) as a test pilot in connection with the development of high-speed types of aircraft.
1947. John Cobb: For his world's land speed records (car) at Salt Flats, Utah—392.8 m.p.h. (kilometre) and 394.2 m.p.h. (mile).
1948. J. D. Derry, D.F.C.: For his achievement in obtaining the 100 km closed-circuit aeroplane record, at Hatfield, Herts; speed, 605.230 m.p.h.
1949-50. Not awarded.
1951. Geoffrey Duke: For upholding British prestige before the world by winning, in 1951, eleven international motor cycle races and becoming world's champion (350 and 500 c.c. classes).
1952. Not awarded.
1953. S/L. Neville Duke—see details of records given above.

Impressive: The simultaneous cartridge start of the 12 Rolls-Royce Avons. "Flight" photographs

CANBERRA TOUR

Six Bomber Command Aircraft To Visit Southern Europe and the Mediterranean

FOLLOWING the very successful goodwill mission by four Canberras to South American countries in October 1952, a second tour, this time to Southern Europe and the Mediterranean, was due to leave this country on Wednesday last.

Flying under the command of A.V-M. J. R. Whitley, C.B., C.B.E., D.S.O., A.F.C. (A.O.C. No. 1 Group Bomber Command), six B.2 Canberras of No. 27 Squadron, based at Scampton, Lincolnshire, will fly a straight-line distance of 8,500 miles before returning to Britain on June 24th. The itinerary is: June 2nd, Rheims (Champagne); June 4th, Rome (Ciampino); June 8th, Athens (Ellenikon, overflying Larissa); June 11th, Istanbul (Yesilkoy, the A.O.C. only also visiting Ankara); June 15th, Belgrade (Batajnica); June 18th, Malta (Luqa); June 19th, Gibraltar; June 21st, Lisbon (Ota); June 24th, Britain (St. Eval and Scampton). Refuelling abroad will be handled by Shell.

Accompanying the six Canberras are two Transport Command Hastings, the first of which will arrive at each stopping-place 30 minutes ahead of the main force to prepare for their arrival. The second Hastings will remain behind to pick up ground crews concerned with the despatch of the bombers. Two reserve Canberras are being kept in readiness at Scampton to take the place of any that may develop trouble. Travelling in the first Hastings is W/C. H. P. Connolly, D.F.C., A.F.C., A.F.M., the Deputy Commander of the mission; he is an Haltonian and was personally responsible for converting A.V-M. Whitley on to Canberras.

At each stopping-place it is intended to put up a display lasting approximately 25 minutes; these demonstrations, it is carefully pointed out, will be non-aerobatic—because the aircraft are fully operational and, therefore, are carrying a number of delicate instruments. It is also stressed that the main object is training, of a kind which would be of particular value should it become necessary under our NATO obligations to reinforce any of the countries visited. Showing the flag is, of course, an important part of the tour and a certain number of V.I.P.s are expected to be taken for flights.

Each display to be given begins with a synchronized start-up of the Rolls-Royce Avons, after which the six taxi out together to the take-off point. Here they separate, the first four taking-off to form a "box" formation and being followed three minutes later by the remaining two aircraft, each of which carry out an individual display to show the high- and low-speed characteristics of the Canberra, its manœuvrability and its climbing power.

It is singularly appropriate that the motto of No. 27 Squadron should be "*Quam celerrime ad astra.*" The first of the two individual Canberras ably demonstrates this by doing a maximum-rate climb from a steep take-off while its companion does a steep turn, keeping within the boundary of the airfield. By this time the formation is ready to fly over the airfield—which it does at about 800ft—and, as they pass, the two individualists make a medium-speed run at a low altitude

The aircrews of No. 27 Squadron and No. 1 Group who will handle the Canberras on their European and Mediterranean tour.

Leaders of the band: A.V-M. J. R. Whitley, A.O.C. No. 1 Group Bomber Command, with, left, W/C. H. P. Connolly, deputy leader, and S/L. D. H. Chopping, the Commanding Officer of No. 27 Squadron.

The formation team: No. 1 is S/L. D. H. Chopping, D.F.C. (WH 730); No. 2, F/L. J. E. Boden (WH 732, A.V-M. Whitley's aircraft); No. 3 F/O. B. Winkworth (WH 733) and No. 4, F/L. G. H. Sizer (WH 861).

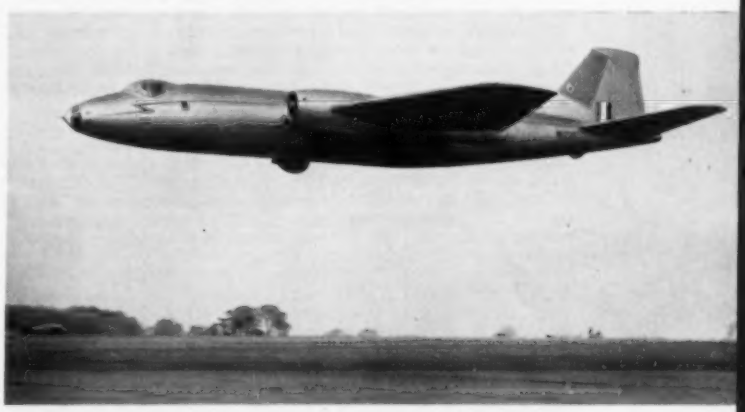
in front of the spectators, splitting up to do a fast and slow run in opposite directions. The programme is then for the formation to return in line astern.

At this point the "fast" aircraft climbs and descends again, this time for slow turns round the perimeter with undercarriage, bomb doors, flaps and air brakes extended. The "slow" Canberra also changes its rôle and makes a high-speed run, after which the two wait for the arrival of the main formation. This they join by forming a separate vee with "one in the box." The final run is in two echelons of three to starboard, from which the Canberras peel off separately for a stream landing. While landing, four of the aircraft are on the runway at the same time.

At a rehearsal demonstration, given at Scampton before leaving, the impression was gained that the flying display lacked showmanship and needed closing up both in time and space. The standard of pilotage is good but with one exception the captains have had less than a year's experience in flying Canberras. No. 27 Squadron itself was re-formed only on June 15th last year. Thursday, May 20th, was the first occasion on which the whole six had been in the air together and, because aircraft and engine inspections would otherwise become due during the tour, no further practice could be carried out after the rehearsal at Scampton on May 25th.

Although the fact is not very apparent from this viewpoint, the Canberra is demonstrating slow flying by circling within the airfield with undercarriage and flaps down, bomb doors open and air brakes extended.

The Canberras look extremely smart in their coats of "high-speed" aluminium paint, with red flashes and squadron badges, and the starting drill leaves nothing to be desired. Taxying, too, is excellent; the whole six keep close together all the way to the take-off point and on return wait just off the



Number WJ 732, which will be flown on the journey by A.V-M. Whitley, seen taking off at Scampton; the undercarriage is in process of retraction. F/L. J. E. Boden will fly this Canberra during demonstrations.

end of the runway until all are present.

Comprising the mission are 25 officers and 53 airmen, the latter formed of the first-line servicing personnel of the squadron. The aircrews are:

No. 1 (WJ 732).—A.V-M. J. R. Whitley, F/L. T. W. Cooper, A.F.M. (who is also A.D.C. to the Group Commander) and F/L. J. E. Boden, who is the reserve pilot and who will fly the aircraft in the displays during which the leader will be on the ground.

No. 2 (WH 730).—S/L. D. H. Chopping, D.F.C. (the commanding officer of No. 27 Squadron), F/L. L. Andrews, D.F.C., and F/Sgt. G. E. Kelly.

No. 3 (WH 861).—F/L. G. H. Sizer, F/O. T. S. Corkin and F/O. M. A. Goodband.

No. 4 (WH 729).—F/L. P. J. Carty, F/O. J. E. Allinson and F/O. E. R. Tarrant.

No. 5 (WH 733).—F/O. B. Winkworth, F/O. D. E. Campbell and F/O. T. C. Taylor.

No. 6 (WH 728).—F/Sgt. G. S. Kerr, F/O. O. F. Temple and F/O. B. A. Loweth.

F/L. Carty and F/Sgt. Kerr are the two individualists.

Even the medical officer accompanying the tour is a qualified Canberra pilot. He took a pilot's course in 1950 and was posted to Binbrook, where the first Canberras came into service. He has been associated with Canberra operations ever since, being the medical officer to the goodwill mission which visited South America and the Caribbean.

ARTISTRY AT STAVERTON

C.F.S. Pilots Show Their Skill for R.A.F.A.

THE air display held at Staverton on Saturday by the Gloucester and Cheltenham branches of the Royal Air Forces Association, in aid of the R.A.F. Benevolent Fund and their own funds, was so admirably organized that it would have been the cruellest luck had the weather interfered. As it happened, a lowering sky lifted as the programme began, the showers ceased, and soon there was sunlight, with the fugitive storm-clouds painting an unforgettable backcloth to the Cotswold scene. The earlier rain probably kept a good many people away; even so, the committee were gratified at the size of the crowd.

We remember few displays which have presented such consistently polished flying, but perhaps that was to be expected, for nearly all the pilots were from the Central Flying School. Lt. J. A. Winterbotham, R.N. (on attachment to C.F.S.), set the keynote with Harvard aerobatics, which included a long inverted climb and an eight-point roll so precise that it somehow suggested the presence of invisible ratchet-teeth. F/O. D. G. Slade followed with a Meteor 7, ending with a stately flaps-down progress, low and slow, along the front of the enclosure; F/L. P. Thomas, from South Cerney, showed that the Provost, thanks in part to its fuel-injection Leonides, is as happy on its back as right way up; F/L. W. C. Kendall threw a T.11 Vampire round the sky, the Goblin's familiar squeal adding effectiveness to manœuvres that included an unusually tight inverted turn and a flaps-down fly-past less than 20ft above the runway; and F/L. C. Bartlett offered some delightful helicoptery, endowing a camouflaged Dragonfly with the playfulness of a Disney animal.

By 3.49 p.m. (not 3.50—such timing was typical of the slickly run programme) cloud-base had lifted sufficiently to give a C.F.S. Meteor 7 foursome all the sky they needed, and the pilots—F/L. R. G. Price (leader), F/L. J. R. Douche, F/O. C. Bart, F/L. C. H. Lazenby—made most spectacular use of it. Early on (we learned subsequently) a large bird struck and damaged Price's windscreen; but no one would have suspected that the leader was flying under such a handicap.

Towed aloft by an R.A.F. Auster 5, a Sedbergh from 92 Gliding School, Colerne (F/O. Hobkick) executed the finger-twirling loops of which only a sailplane is capable; A. J. Harrison—an ex-pupil of "Dumbo" Willans' academy—stepped out of an Auster at 1,500ft and succeeded in alighting neatly on one of the few parts of Staverton's surface not encumbered by factories or (as on this occasion) agricultural-show marquees; and F/L.s Ware and Cockburn from Bristol University Air Squadron capably performed the time-honoured instructor-and-pupil act.

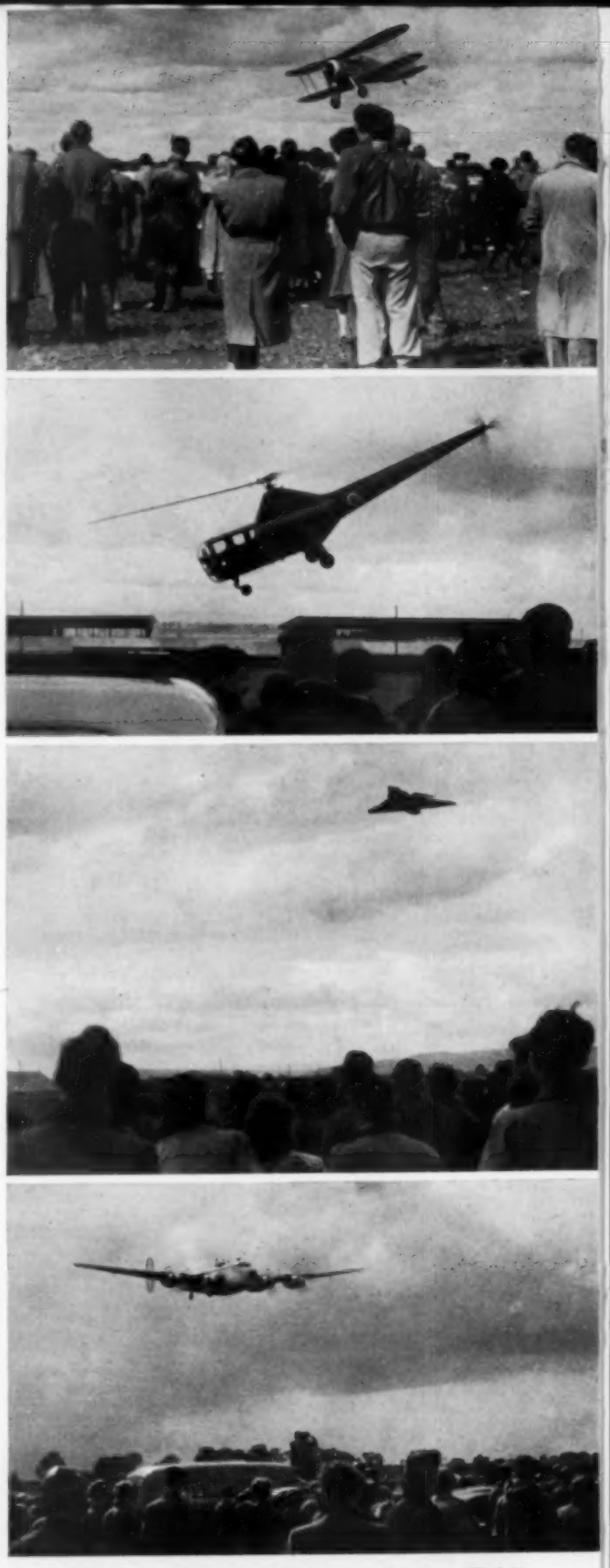
The next item was something quite out of the ordinary: the one and only Gloster Gladiator, G-AMRK (Bristol Mercury), which, as we recorded last week, its original builders have acquired from Mr. V. H. Bellamy. Gloster's Geoff Worrall flew it very prettily indeed, and the biplane fighter's nimbleness must have been an eye-opener to the jet-educated lads of today. For us, it brought on a severe attack of pre-1939 nostalgia.

Also unconventional was the next turn, contributed by Dakota G-AMZE, which is a very smart M.o.S.-owned aircraft operated by Smiths Aircraft Instruments and stuffed full of experimental approach and blind-landing equipment. A fortnight before, its yawmeter-probe had been struck off by lightning, but it had sprouted a new one fully four feet long. R. A. Palmer's demonstration, wholly asymmetric, included turns "towards" the dead engine.

Feathering now seemed fashionable, for the aircraft which followed, a Shackleton of No. 206 Sqn., Coastal Command, arrived on the power of its four Griffons; then, in successive passes, the pilot cut one each time, finally making his exit on one only.

Lt-Cdr. Mike Lithgow in a Swift was unavoidably an absentee, but the crowd had the "Farnborough thrill" they wanted when W/C. Dicky Martin, Gloster's chief test pilot, thundered over from Brockworth in the fourth prototype Javelin, its Sapphires (on one run) trailing black smoke against the now lowering storm-clouds. Martin's brief but exhilarating demonstration made a magnificent finale, and then the rain-curtain fell.

Of this generally praiseworthy show, we cannot forbear to add a special word in appreciation of the extraordinarily informative commentary by Mr. J. Bennett. When he retires from the post of C.F.I. at Staverton he might consider starting a school for air-display announcers.



Non-stop variety programme: Reading downwards, these "Flight" photographs show Geoff Worrall cavorting prettily in the one-and-only Gladiator; F/L. C. Bartlett putting a Dragonfly into one of several improbable attitudes; S/L. Dicky Martin providing the top-of-the-bill act with the kinked-leading-edge Javelin; and a Coastal Command Shackleton MR.1 coming down-wind and down-sun.

"Flight" photographs

(Centre) Auster Aircraft chief technician F. Watkin does most of the work connected with the competition; he is seen opposite his wife and daughter, checking watches at the reception of Messrs. Johnston and Edwards of the Fair Oaks club. (Left) E. A. Cowan and G. A. Farley changed places this year and were awarded third prize; in previous Auster/Ragosine contests they have won second and first prizes. (Right) The only Service participants were Capt. A. S. Everett and J/Tech. L. G. B. Snuggs, of 661 A.O.P. Squadron, Kenley. They flew a silver Auster T.7.

PUZZLE CORNER

—*for Auster Crews: The Ragosine Trophy Competition*

THIS year's Ragosine/Auster Homing Trophy competition was flown off last Saturday afternoon, from Auster's Rearsby, Leics, airfield. A record number of Auster owners or operators entered and, in spite of not-too-favourable weather, 35 actually participated.

As in previous years, the groundwork of the contest had been largely carried out by Auster's chief technician, Mr. F. Watkin, acting as competition secretary. Each year the task set seems to be harder, and this year was no exception. After take-off, each participant had to count the number of single-track and double-track railways between Rearsby and Elmdon, while keeping an eye open for a series of old buildings—of which photographs were provided—situated round the course.

Various other tasks faced the competitors over the succeeding legs to a point 3,700 yd east of Warwick airfield, on to Foxton—across a blanked-off region on the quarter-inch map—and then to Market Harborough. At this last point competitors were allowed to open another envelope of instructions, which began "This is the shock! Cancel all briefing instructions, and go back to count the lock gates on the Grand Union Canal at Foxton . . ." and so on, until Rearsby was again reached, the landing being a power-off, full-flap affair from 1,000ft on to a spread parachute. Even then, there remained a hurricane 60-second "last straw" interrogation.

In spite of all this, the winners lost only 27 points; they were N. A. L. Thorne and L. True, of Leicester Aero Club, flying an Autocrat. They received the Ragosine/Auster trophy, a silver replica, and cash prizes of £20 (pilot) and £10 (passenger); in addition, the fact that they were flying a Cirrus-engined Autocrat gained them the handsome Cirrus Trophy and replica.

The next-best competitors tied with 33 points lost; but, owing to the fact that A. H. Jelly and J. P. Gill (who flew a blue J.4) had fewer flying hours, they were awarded second place. Third place went to the other 33-point pair, E. A. Cowan and G. A. Farley (Autocar), who had changed seats in relation to the 1951 and 1953 contents, when they gained first and third places respectively. Other prizewinners included:

Best timekeeping, T. F. Ringer, a Norfolk farmer who was only 1½ min out altogether, using D.R. throughout. *Best observation*, J. D. H. Radford, whose passenger, Miss Z. Paddon, won the ladies' prize of a fine picnic hamper and also received a year's subscription to *Flight* for the best passenger observation. *Novice's prize*, G. E. Jervis, of the College of Aeronautics, Cranfield, with G. E. D. Bonham-Carter as passenger. *Best "first year" participant and passenger*, D. L. Pratt and P. G. Hardie-Bick.

In addition, all passengers were asked, at the last turning point, to write an essay giving their views on the Ragosine/Auster competition; some of these made most entertaining reading, and I. C. Davenport's effort was rewarded with the prize of a pen.

THE PERCIVAL RALLY

AT Luton, on Saturday, the "At Home" for owners and pilots of Percival-built aircraft was attended by some 25 machines, the ubiquitous Proctor types forming the majority. The arrival contest was won by Mr. G. P. Reece in his Proctor 5 G-AIEP, flown from Cambridge, and the same machine went on to win the *Concours d'Elegance*. For Service aircraft, the arrival prize was won by S/L. Paston Williams in Air Chief Marshal Sir Basil Embry's personal Pembroke; while in the *Concours* a special award was made to the Prince belonging to the Standard Motor Company and flown by Capt. W. Poulter.

Demonstrations by various Percival aircraft followed. Jean Batten's Gull G-ADPR, a Proctor, Prentice prototype, Provost and Pembroke were displayed respectively by pilots Joe Arnold, W/C. A. N. Kingwill, Barry Radley, R. G. Wheldon and Lt. Oliver, R.N. The customarily polished aerobatic display by "Dicky" Wheldon in the Provost was not omitted.

The prizes were presented by Mrs. C. P. M. Hunting, wife of one of the Hunting-Percival directors, who also welcomed the guests from Luton and farther afield. A brief speech on behalf of the guests was made by Dr. Charles Hill, M.P. for Luton.

PEMBROKES FOR SWEDEN

A CONTRACT for "a substantial number" of Pembrokes has been signed between Hunting Percival Aircraft, Ltd., and the Swedish Government on behalf of the Royal Swedish Air Force. Normally equipped for the carriage of eight passengers in rearward-facing seats, these particular Pembrokes will be provided with accommodation for ten.

Since the Pembroke (two Alvis Leonides) first went into R.A.F. service in 1952 the type has also been supplied to the Royal Belgian Air Force and Southern Rhodesian Air Force. The Royal Swedish Air Force is thus the fourth to adopt the Pembroke.

LONDON AEROPLANE CLUB CHANGES HANDS

IT may now be announced officially that the London Aeroplane Club, operating from Panshanger airfield, Hertfordshire, has, together with all its assets, been acquired by Mr. J. N. ("Nat") Somers. Pending negotiations with the Town and Country Planning authorities and others, the ownership of the airfield itself has not yet changed.

In pre-war days, when the London Club was at Hatfield—where it enjoyed the use of particularly pleasant premises now immured amid buildings comprising the de Havilland works—it was among the most active and best known, for both flying and social activities. Although its present site at Panshanger is not quite so convenient as was Hatfield, there are available nevertheless a pleasant clubhouse, hangarage, a restaurant, bar and the usual facilities.

The fleet at present comprises five Tigers, two Chipmunks, one Hornet and one Autocrat. The C.F.I. is Mr. D. H. Macbeath (telephone Essendon 301 or 305), and the chief engineer is Mr. George Hart, who also serves the de Havilland Technical School, which likewise uses Panshanger.

HERE AND THERE

Former C.A.S. Joins Industry

THE appointment is announced of Marshal of the Royal Air Force Sir John Slessor as a director of Blackburn and General Aircraft, Ltd. From 1950 to 1952 Sir John was Chief of the Air Staff.

Tigers for France

SEVERAL flying clubs overseas have recently profited by the sale—very cheaply—of Chipmunks from the Southern Rhodesian Training Group; and now ex-R.A.F. Tiger Moths are going to France; R. A. Peacock (Aviation), Ltd., of Croydon, are ferrying out large batches to a private company there.

New Danger-Point?

TWO C-124 Globemasters of the U.S. Military Air Transport Service were being prepared last week at Mobile, Ala., for the carriage of 50 tons of weapons, ammunition and jeeps to Nicaragua and Honduras. This follows a recent shipment of arms from Poland to Communist-dominated Guatemala.

Washington Post

THE M.o.S. announces that A. Cdre. L. R. S. Freestone, O.B.E., A.F.R.Ae.S., has been appointed to succeed A. Cdre. C. L. Dann, C.B.E., as Director (Air) of Technical Services, British Joint Services Mission, Washington, U.S.A. A. Cdre. Freestone has been Director of Armament Engineering, Air Ministry, since late 1952.

NINE-DAY WONDER—in the most complimentary sense: The U.S. Navy airship which landed at Key West (Florida) on May 27th, after cruising, unrefuelled, for 200 hr 4 min. The previous endurance record, by a Goodyear M-type ship, was 170 hr 20 min, in 1947. The present craft, described as a Goodyear ZPG-2 of 342ft overall length, carried a crew of 15.

Waterloo Helicopters, new Version

SABENA are operating regular Sunday tourist flights with S-55 helicopters over the battlefield of Waterloo.

MILITARY AIRCRAFT REVIEWED

THREE weeks from now—on June 25th — the Military Aircraft of the World number of *Flight* will appear. There is certain to be a heavy demand for this greatly enlarged, profusely illustrated special issue, and we suggest that readers should place advance orders with their newsagents.

This Name Makes News

FORMER chief test pilot of the Gloster Aircraft Co., Ltd., S/L. "Bill" Waterton has joined the staff of the *Daily Express* as air reporter.

Ulster Date-Change

POSTPONEMENT of the Newtownards flying rally from July 10th to Saturday, July 31st, is announced by the Ulster Flying Club.

Model Occasion

LADY BOYLE, wife of Air Marshal Sir Dermot A. Boyle, A.O.C-in-C. Fighter Command, is to present the Queen Elizabeth Cup at the annual gala day of the Northern Heights Model Flying Club (Hawkers' Langley Airfield, June 20th).

Cranfield Ball

FORMER Cranfield students who have not yet received notice of the Student Society's presentation ball (July 9th) can obtain tickets (£1 5s single) from F/L. A. H. Craven, Lanchester Hall, College of Aeronautics, Cranfield.

Held Captive

THE M.T.C.A. last week partially relaxed the ban which they had placed on the flying of a helicopter built by Mr. John Murray, of Salford, Lancs, without A.R.B. supervision. They will now allow him to make tethered flights, and these will take place shortly at Barton Aerodrome.

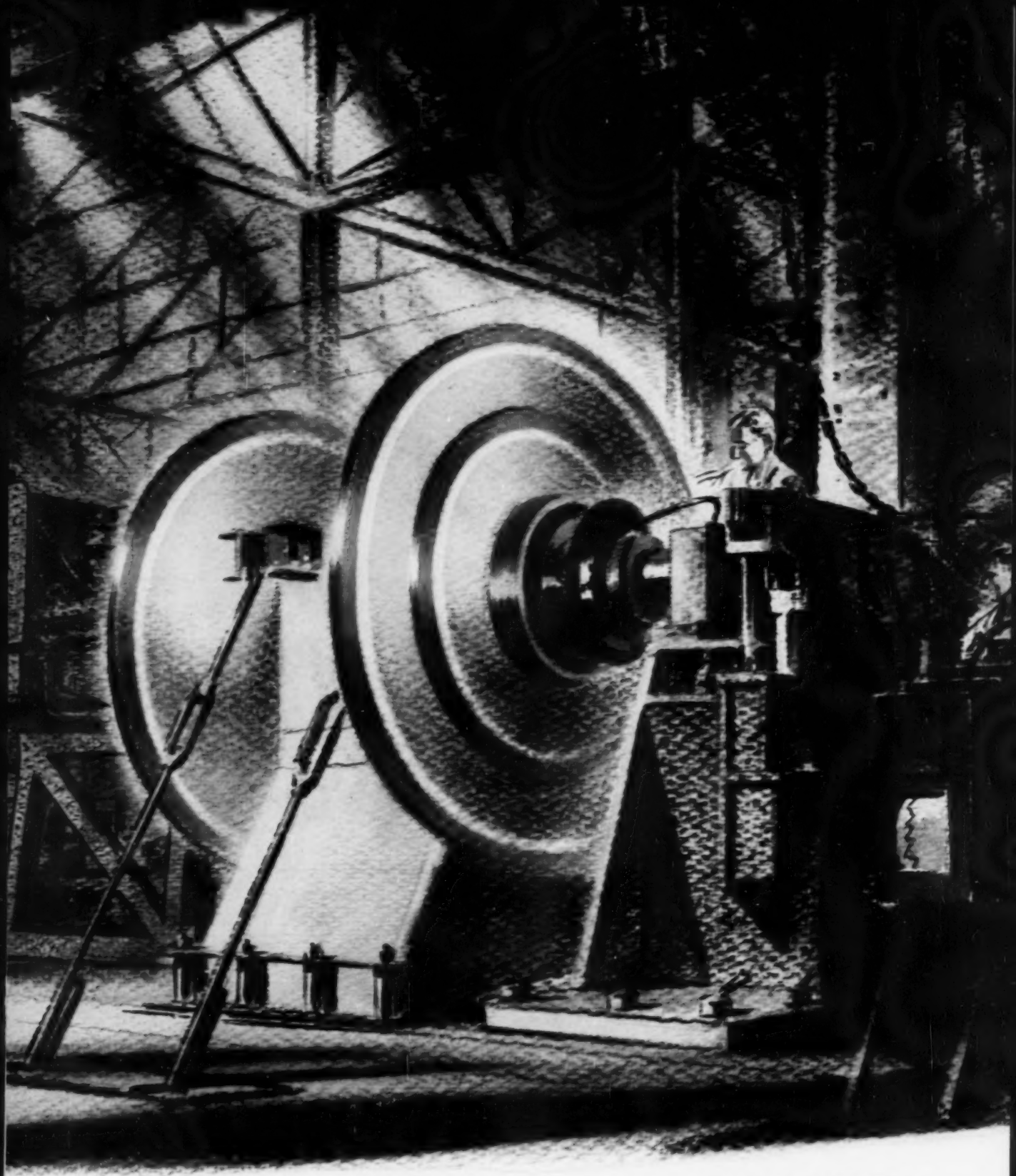
Bella!

LARRY BELL, president of the Bell Aircraft Corporation, describes as a "good show" completion of the first Model 47G helicopter by the Italian licensees, Construzioni Aeronautiche Giovanni Agusta, of Milan. The machine will shortly be delivered to the Italian Air Ministry. With sales restricted to Continental Europe (excepting France) Agusta hold one of two foreign manufacturing agreements negotiated by Bell. The other is held by the Nippon Machinery Trading Co., of Tokyo.

Up and Up

LESS than three weeks after the Glenn Martin/U.S.N. Viking No. 10 rocket had equalled the altitude record of 136 miles achieved by both No. 7 and No. 9, Viking 11 was fired from White Sands proving ground on May 24th. It attained a new record of 158 miles. A Viking rocket is 42ft in length and weighs 7½ tons; powered by a 20,000 lb-thrust unit made by Reaction Motors, Inc., and burning alcohol and liquid oxygen, it reaches over 4,000 m.p.h. at its "all burnt" altitude.

FIAT AT FILTON: Senior members of the famous Italian firm visited the Bristol Aeroplane Co. last week. Seen in this group, photographed in a Britannia's interior, are (left to right):— Mr. R. S. Brown, Bristol aircraft division general manager; Sgr. F. Prassio, Fiat London manager; Mr. L. S. Armandias, British Messier deputy managing director; Prof. V. Valetta, Fiat president; Sir Reginald Verdon Smith, Bristol joint managing director; Dr. Ing. G. Gabrielli, Fiat chief engineer; and Dr. A. E. Russell, Bristol chief designer.



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SLOUGH

AIRCRAFT in AGRICULTURE

History of Aerial Topdressing in New Zealand

ALTHOUGH aerial topdressing is practised in several other countries, it is in New Zealand that the fertilizing of pastoral hill-country from the air has made the greatest strides. The need has now arisen for a specialized topdressing aircraft to replace the several types of light aeroplanes which have hitherto been adapted for this work.

At the recent 71st meeting of the Sydney branch of the Royal Aeronautical Society's Australian division, a symposium was held under the above title. We print here extracts and digests from several of the contributions.

In the few years that have elapsed since it became a commercial possibility, aerial topdressing in New Zealand has become a major branch of the civil aviation industry. In the short period of four years the number of firms engaged in aerial topdressing has grown from five in 1949 to 38 in 1953. The main reason for the increasing popularity of spreading fertilizer from the air is that in New Zealand there is a vast amount of hill country to which access is difficult and which would be costly and time-wasting to topdress by hand. In fact, a considerable amount of back country in New Zealand could not be artificially fertilized at all if it were not for the development of aerial topdressing.

As early as 1926 a New Zealand farmer wrote to his M.P. to make the proposal: "We have millions of acres of hill land requiring topdressing which could never be done by hand, but it might be worthwhile to try it from the air." His suggestion did not receive a very good response as it was considered to be impracticable.

Nothing further is recorded until 1938, when Mr. A. M. Pritchard, chief pilot to the Public Works Aerodrome Services, came forward with facilities at his disposal for putting his ideas into practical effect. He was given permission in 1939 to carry out limited trials in aerial seed-sowing on sand dunes at the Ninety Mile Beach, North Auckland. Owing to the difficulty of securing sufficient seed, full-scale trials were impossible, but at least this was a step in the right direction.

The next seed-sowing trials were on a much larger scale and took place in May 1943. The same area as that first used was again selected and these trials were reasonably successful. About one ton of seed was dropped, involving approximately seven flying hours and spread over two days.

After the war Mr. Pritchard took steps to bring the realization of his dreams a little closer. With improvised equipment the first aerial topdressing experiments in New Zealand were carried out near Thames in 1946. Using a Public Works Department Aircraft, copper sulphate or bluestone crystals were successfully spread from the air.

During 1947 further trials were carried out, particularly by the Department of Agriculture. In the same year the Soil Conservation and Rivers Control Council began to display interest in aerial topdressing. The Council was interested in the idea as a means of checking and preventing soil erosion and improving hill country. The R.N.Z.A.F. was eventually called upon to undertake trials over hill country, using a Grumman Avenger torpedo bomber, suitably modified. Later on, as experiments progressed, two more Avenger aircraft were modified for trials and a large-scale operation was eventually undertaken. Real interest was now being shown by farmers, and various statistics relating to distribution and costs were prepared. By 1949 aerial topdressing was shown to be economical and operationally possible so that the way was now open for commercial exploitation.

The first commercial operator was a company in the South Island—Airwork (New Zealand), Ltd., who submitted drawings of a hopper for approval to the Civil Aviation Branch in September 1948. This design was approved in January 1949, and the completed hopper was fitted to a Tiger Moth. Preliminary trials began in February and March of 1949, at first using seed and lime.

A valuable guide to the performance and possible costs of light aircraft in aerial topdressing was contained in a report prepared in 1949 by the Director of Civil Aviation, Mr. E. A. Gibson, and presented to the Advisory Co-ordinating Committee on Aerial Distribution of Fertilizer and Seeds.

A series of trials undertaken to test the efficiency of the distribution of fertilizer from light aircraft, an aspect of particular importance to commercial operators, was undertaken by a North Island firm early in 1950. These trials were carried out with a Tiger Moth aircraft and were undertaken in co-operation with the Department of Agriculture.

"Although hampered somewhat by their small payload and low reserve of power, Tiger Moths soon proved the most suitable aircraft available. . . ."

In December 1951 further comprehensive distribution measurement trials were conducted. They compared fertilizers of different-sized granules and established the fact that the finer granules gave the best spread. A height-of-flying trial was also made.

Three kinds of fertilizers were dropped, ordinary superphosphate, granulated superphosphate and serpentine superphosphate. The measured area was about 7½ acres (actual target area five acres) with the aircraft flying at 70ft above the target area at an indicated airspeed of 80 m.p.h. The collection was done by means of boxes placed at fixed intervals along and across the flight lanes, and the resultant measurement showed little difference in mean density on the target area for the three kinds of superphosphate used. The mean densities for granulated and serpentine superphosphate were 1.3 cwt per acre, whilst that for ordinary superphosphate was 1.2 cwt per acre. No allowance was made for fertilizer bouncing out of the collection boxes. The tests showed that a high standard of efficiency could be achieved by an experienced pilot.

Commercial aerial topdressing activities in New Zealand in the initial stages were no doubt largely helped by the fact that large numbers of surplus Tiger Moths were available fairly cheaply. When suitably modified these were, if not the ideal aircraft for the job, at least quite a useful makeshift. Although hampered somewhat by their small payload and low reserve of power, Tiger Moths soon proved themselves the most suitable aircraft available in New Zealand for aerial topdressing. Even today practically all aerial work aircraft are members of the Tiger Moth tribe, a few Beavers, Austers and Cessnas making up the balance. Fitted with hoppers designed and made in New Zealand, Tiger Moths have literally "carried the load" in aerial topdressing operations to date.

A tour of the North Island in 1949 by Mr. Gibson, with Mr. Pritchard, was largely responsible for the rapid increase in the number of aerial work firms in 194-50. At least 12 operators entered the field as a result of this trip.

As time went on more companies joined in, but unfortunately two factors arose which tended to hold back development and use. The first of these was that the previous fortunate position as regards the supply of suitable aircraft had changed somewhat. As more operators began activities the surplus of D.H.82 Tiger Moths was absorbed to a large extent. The second factor was that the superphosphate stocks in New Zealand were not very good and supplies were difficult to obtain.

To protect the interests of the growing number of aerial work operators, it was decided in 1949 to form an association of these companies. The Civil Aviation Branch played a prominent part in the establishment of this association. In addition to safeguarding the interests of its members, the association would be interested in improving the techniques used in aerial work operations. To this end an inaugural meeting was held in Wellington on September 27th, 1949. Invitations to be present were sent to all active and intending aerial work operators.

Operational economy: An Auster Autocrat used for early post-war experiments in crop dusting.

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Fifteen of these firms and individuals attended this meeting. A draft organization was presented to the meeting and a resolution was passed forming an association to be known as the "Aerial Work Operators' Association (Incorporated)." A provisional committee was also elected.

In December 1951 it was decided to alter the rules of the association to include the aviation industry as a whole and the name was changed to the "Aviation Industry Association of New Zealand."

Although there have been no major revolutionary changes in aerial topdressing over recent years, there has been a steady improvement in techniques employed both in the air and on the ground. The Beaver, which has over three times the fertilizer payload of the Tiger, was introduced to New Zealand in early 1951. It promises to be a very suitable type.

At present an aircraft is being built in the United States which has aroused considerable interest in New Zealand. Known as the Fletcher FU-24, it is the first aircraft ever to be designed specifically for aerial farm work in New Zealand. It has a payload of half a ton compared with a quarter of a ton carried by the Tiger Moth and three-quarters of a ton carried by the Beaver. There are about 100 of these aircraft being manufactured for aerial topdressing in New Zealand. Associated with the development of this special aircraft for this work are the proposals at present under negotiation with the Meat and Wool Board for financing operators with the necessary funds.

The figures relating to aircraft types engaged in aerial topdressing in New Zealand show that, at September 30th, 1953, there were 148 Tiger Moths, five Austers of different marks, five Beavers and two Piper Super Cubs in operation. These figures show clearly the predominant rôle played by the Tiger Moth.

The subject of accidents in aerial topdressing has for some time been the cause of much discussion and concern both inside and outside the industry. Although the figures show that there has been quite a large number of accidents involving topdressing aircraft during the period January 1st, 1950, to March 31st, 1953, the number of fatal accidents has been very few. Out of a total of 149 accidents involving aircraft engaged in such operations, seven were fatal, and, in addition, 15 persons were injured. Of the seven persons who lost their lives not all were actually engaged in aerial topdressing operations at the time of the accident which caused their death; some were either ferrying the aircraft or were engaged in flying complementary to aerial topdressing. The number of aircraft written off as results of accidents in aerial topdressing during the period in question, was 16; and there were also 106 major accidents.

This figure seems high, but it must be borne in mind that the somewhat hazardous nature of the operations tends to make the accident-rate high in comparison with other forms of civil aviation activity. On the other hand, the very small number of fatalities has shown that, while there are real dangers involved in the spreading of fertilizer from the air, for various reasons the majority of accidents have involved no loss of life or injury to those concerned. Moreover, considering the large numbers of take-offs and landings which occur each year in aerial topdressing, the ratio of accidents that have taken place during these two most critical phases of flight to the total aggregate of take-offs and landings is surprisingly low. In fact, the ratio is about one accident for every 100,000 take-offs and landings.

Although this short history has been concerned primarily with aerial topdressing as the major part of aerial activities as a whole, it must not be forgotten that this type of operation has as a background another form of aerial work viz, aerial seed-sowing. Closely allied with aerial topdressing there are in New Zealand today such activities as seed-sowing already mentioned, rabbit poisoning, dropping of supplies and fencing material, weed killing, and crop spraying. All the same, it is topdressing itself which is by far the most important section of this class of aviation activity and it is a part of aerial agriculture which has been mainly a local development.

For the year ended March 31st, 1953, nearly 1,400,000 acres were treated. The subsequent rate of progress indicated that in 1953-54 approximately 200,000 tons would be spread over hill country totalling in the vicinity of two million acres, most of which had never seen superphosphate until the advent of the aeroplane. The significance of this aerial farming will be appreciated if—as is claimed by some advocates of the method—each acre of hill country will, in the fifth year of application at present prices, produce on the average an extra £5 of income. With some 13,000,000 acres of hill country on which this method is applicable the possibility of increasing New Zealand's annual wealth from farming by another £65,000,000 is one that cannot in these days of world food shortages be neglected.

A set of three two-ton hoppers, filled with fertilizer and clover seed, used by a Bristol Freighter for its recent demonstration in New Zealand.

A D.H. Canada Beaver dropping chemical fertilizer, of which 1,850 lb may be carried. A spray boom can be fitted for use with liquid insecticides.

TIGER MOTH MODIFICATIONS

FROM the outset, the engineering side of aerial topdressing has had a constant struggle to keep up with the increased skill and improved methods of operation. The first Tiger Moth to be used for topdressing was modified by removing the seat and stick from the front cockpit and cutting a hole through the cockpit floor. Into the cockpit was fitted a leather bag with a metal frame-end which came through the hole in the floor. The shutters on this door were fitted with a control so that the pilot could operate them. The aircraft was loaded manually as it only carried one bag of 180 lb.

Soon a new metal hopper was designed. This was folded up and fitted into the front cockpit and then extended to its full size. The sides of the hopper were then slid into place and secured with screws and stop nuts. This new hopper increased the load to about 300 lb per trip.

The hand loading method proved to be far too slow for this improved topdresser and a better method of loading had to be devised. A hay boom was rigged on the job and a canvas hopper fitted into the boom. The superphosphate was loaded into the canvas hopper, which was elevated to a convenient height. When the aircraft landed, two of the loading staff would run out and lift up its tail and wheel it backwards under the boom. A cover made like a curved dustbin lid was put over the pilot's cockpit before the fertilizer was dropped from the canvas hopper into the aircraft hopper. But this improvement, which had more than doubled the tonnage, still did not prove to be good enough—the pilot soon mastered it and was eager for a greater load.

As no further improvement could be made with the removable-type hopper, the aircraft was drastically altered to take a larger one. Everything was removed from the front cockpit and two tubular metal frames were fitted, one on each side of the cockpit. The wings, centre section and top fuselage fairing were removed and a large narrow galvanized iron tank was fitted between, and bolted to, the two metal frames. The aircraft was assembled again and, as the top of the tank was level with the top of the fuselage, a fairing was made to cover right over the front cockpit and a spring-loaded lid was fitted, which covered over the top opening of the hopper tank. The aircraft was now capable of carrying 450 lb of fertilizer and still able to operate from farm paddocks or airstrips bulldozed out of hill sides.

The worry was now with the loading, for the aircraft was so improved that the old system was far too slow. It was realized that, rather than the aircraft being wheeled under the boom with its canvas hopper filled with manure, the boom must move to the aircraft. The only way of doing this was to build the boom on a truck.

A large T-shaped boom was made and mounted on bearings fitted to a heavily reinforced section which took the place of the front bumper of the truck. A winch was then mounted under the tray of the truck and through a system of pulleys a cable was run up through the boom and out to one end of the "T." The canvas loading hopper could now be raised or lowered mechanically. However, it was soon found that loading operations could be further streamlined by keeping the boom in a fixed position and driving the truck from the manure loading stack to the aircraft for reloading its hopper.

It was also found that the aircraft was capable of carrying yet a further 100 lb of fertilizer, bringing the payload to 550 lb. This is the maximum payload approved for Tiger Moths.

With a full load of a quarter of a ton, very little reserve power was available in emergencies, and a series of accidents occurred. It was necessary, therefore, for the outlets on hoppers to be modified for jettisoning, and this was the next improvement carried out. The jettison, when finally approved, was capable of releasing a full load in about five seconds.

A further modification was introduced about two years ago by fitting a collapsible seat in the hopper for carrying the loader operator to and from the airstrip (the operator's staff usually return to base every day after work).

The Tiger Moth has stood up to the strain of aerial topdressing in a remarkable way and its maintenance cost has not been high as is sometimes thought. The availability of replacement Tiger Moths and spare parts, however, is becoming exhausted and very soon they will have to be completely replaced by new aircraft.

EFFECT OF TOPDRESSING AND SEEDING

THE great majority of hill country soils in New Zealand are deficient in phosphate; some are deficient in lime, many in molybdenum, and in only a few areas is potash required. The main effect of these deficiencies is seen in the absence of clovers in the pasture or in the presence of only a sparse cover of unthrifty plants.

The effect of topdressing pastures completely devoid of clover may be disappointing. The grass species do not respond to phosphates, lime, potash or molybdenum as readily as do the clovers. In fact, in a clover-deficient sward, pasture production is likely to be limited, not by the fertilizing elements just indicated, but by nitrogen. Fertilizer application of nitrogen materials is out of the question, due to the high cost of nitrogenous fertilizers and frequent heavy applications of these that would be required to secure a sustained response. The hill-country farmer must, therefore, look to the clovers as his main source of nitrogen supply to the grass elements of the sward by stimulating the clovers with phosphates and other fertilizers.

From this it may be seen that a vigorous clover element in the sward must be the first aim of topdressing. Where clovers are not present, seeding is being widely practised, with rather variable results. However, if seeding is done at the right time, with the right species and with adequate fertilizer, it may be expected to give pastures with greatly improved clover content and vigour and, as a result, more productive grasses and much-improved stock carrying-capacity.

Much hill country in New Zealand carries pastures with considerable amounts of annual clovers. These species will respond to topdressing, sometimes in a remarkable manner, but neither their production nor their nitrogen-supplying power approaches that of white or subterranean clover. For this reason pastures with annual clovers only should be seeded as well as topdressed.

The impact of aerial fertilizing and seeding on hill country farming in New Zealand has hardly been felt as yet, but it must soon become a major factor in pastoral production.

(*To be continued*)

MOULDED-PLASTIC DROP TANKS

TWO well known firms, F. G. Miles, Ltd., and British Emulsifiers, Ltd., have lately co-operated in the formation of a new company under the title of Jet Tanks, Ltd. When it is remembered that the aircraft firm have a versatile plastics division at their Shoreham Airport works, and that their partners in the venture have been making drop tanks and other sheet-metal aircraft components for the past 20 years, the nature of the new enterprise begins to become apparent: its principal object, in fact, is the development and manufacture of tanks—particularly drop-tanks—in non-metallic materials. Other products in the same general line may follow.

Two basic "Milestos" plastics, phenolic-resin-bonded asbestos fibre and similarly treated glass fibre are the materials principally being employed in the tank development work, which is being done at Shoreham (production will begin shortly at a works in Islington, London). The drop tanks, in any size, are moulded not in longitudinal halves, as might be thought, but in three transverse sections—nose, centre and tail—several varying methods of fuel-tight joining having been developed. These methods will permit simple assembly of transported sections "in the field."

Design-advantages afforded by the use of moulded plastics include the consideration that thickness can conveniently be added where required for local strengthening. Attachment-fittings, valves, etc., are moulded in. The material is proof against any fuel used, or foreseen, in jet aircraft, and against ester lubricants. As regards vulnerability to machine-gun or cannon fire, test specimens we have examined suggest that penetration is clean both on entry and exit, without crumpling or tearing.

No detailed figures for weights are yet available, but it is expected that the tanks will be somewhat lighter than metal tanks of similar capacity. In general, however, the company's aim will be "same weight at lower cost."

Jet Tanks, Ltd.—the directors of which are Mr. F. G. Miles, F.R.Ae.S. and Mr. G. A. Rickards, M.C.—have their offices at 3, Red Place, London, W.1 (Mayfair 9358 and 0708).

CF-100 UNOFFICIAL RECORD

NEWS appeared in *Flight* of February 5th of an unofficial unrefuelled-distance record for jet fighters set up by a CF-100 of No. 445 All-Weather Sqn., R.C.A.F. The aircraft flew 2,100 miles from Vancouver to North Bay non-stop in 3 hr 55 min. Belatedly, some further details of the flight have become available, and are worth quoting.

The flight was planned by the crew one night and the take-off made at 0700 hr next morning. They climbed to 34,000ft in cloud and, using the "climb cruise" technique, thereafter gained height at the rate of 33 ft/min. Their only sight of the ground was at the lake-head cities on Lake Superior about an hour before landing. It was not until the evening of the day of the flight that the news leaked out to the local Press. The navigator, F/L. Turner, is now on an exchange posting to an R.A.F. night fighter squadron in the U.K. The pilot was F/L. M. Kobierski.

GROUND-ATTACK MARKSMANSHIP

Light Aircraft Wage War on Wolves in Arctic Alaska

By FRANK ILLINGWORTH

AMERICAN pilots in Arctic Alaska are engaged on a spectacular operation: hunting wolves in light aircraft whose only "armament" is a weapon normally used against rabbits—the 12-bore shotgun. The aircraft of what might be called the "Wolf Wing" comprise the Piper Cubs, Cessnas, Bellancas, Stinsons and Aeroncas that at other seasons are engaged in carrying mail and freight to remote settlements. The pilots are all civilian bush-flyers; but the wolf sweeps are planned with the precision of military operations.

The caribou and reindeer herds of Alaska are of great economic importance to the Territory, providing a local supply of meat to Eskimos, Indians and the growing number of prospectors, miners, surveyors and settlers, and the men of the chain of U.S. military outposts in Alaska. Wild-life authorities estimate that one wolf kills up to 75 reindeer and caribou annually. It followed that the wolf packs must be reduced.

Hence the formation of a "Wolf Wing" in 1949. Operating in the Nelchina area of south-west Alaska, it accounted for only 23 wolves in its first year. By 1952 the Wing was using three new 125 h.p. Piper Super Cubs and a Piper J-5C and, operating across almost unexplored polar desolation from the airstrip at Umiat (barely 150 miles from the most northerly point of Alaska) it accounted for nearly 200 wolves. More were shot from the air last year, and future sweeps may well bring the annual "bag" up to between 300 and 400 animals. The last wolf-sweep based on Umiat started as early as October, fuel, spare parts, food, clothing, sleeping-bags, tents, shotguns and boxes of 12-bore cartridges being flown to the airstrip there from Fairbanks, the largest air base in Arctic America.

Typical of the conditions which sometimes face the wolf-hunters—one of whom is seen carrying his shotgun—is this photograph taken in early March during a thaw sandwiched between two "40 below" spells. The aircraft are a Cessna 170 and a Norseman of Wien Alaska Airlines.

The Americans are drilling for oil in the neighbourhood of Umiat, no doubt with a view to building a refinery for the benefit of U.S. Forces in Arctic Alaska. It is undeniable that an Alaskan parallel to the war-time Canol Project (the construction of the refinery in sub-Arctic Canada, from which fuel was piped to the Alaska Highway and the string of airfields handling Lease-Lend aircraft bound for Siberia) would be of great strategical advantage to U.S. air bases in Alaska, and particularly to the strategically important base hard-by the most northerly point of Alaska, Point Barrow. Meanwhile, Umiat airstrip serves not only the oil camp but Alaska's airborne wolf-hunters.

That light aircraft and 12-bore shotguns are an ideal combination against the wolf is confirmed by the "bags" of individual gunners. For example, one marksman (who on one occasion shot a blade-tip from his Piper's airscrew) has accounted for more than 50 animals in one year. Another, named Cliff Hudson, killed a pack of six wolves in ten shots. Frank Glazer, a small man with many years of bush-flying experience, told me of shooting ten out of a pack of fourteen. "All the wolf can do is keep on running," he said, "And all you have to do is run it down."

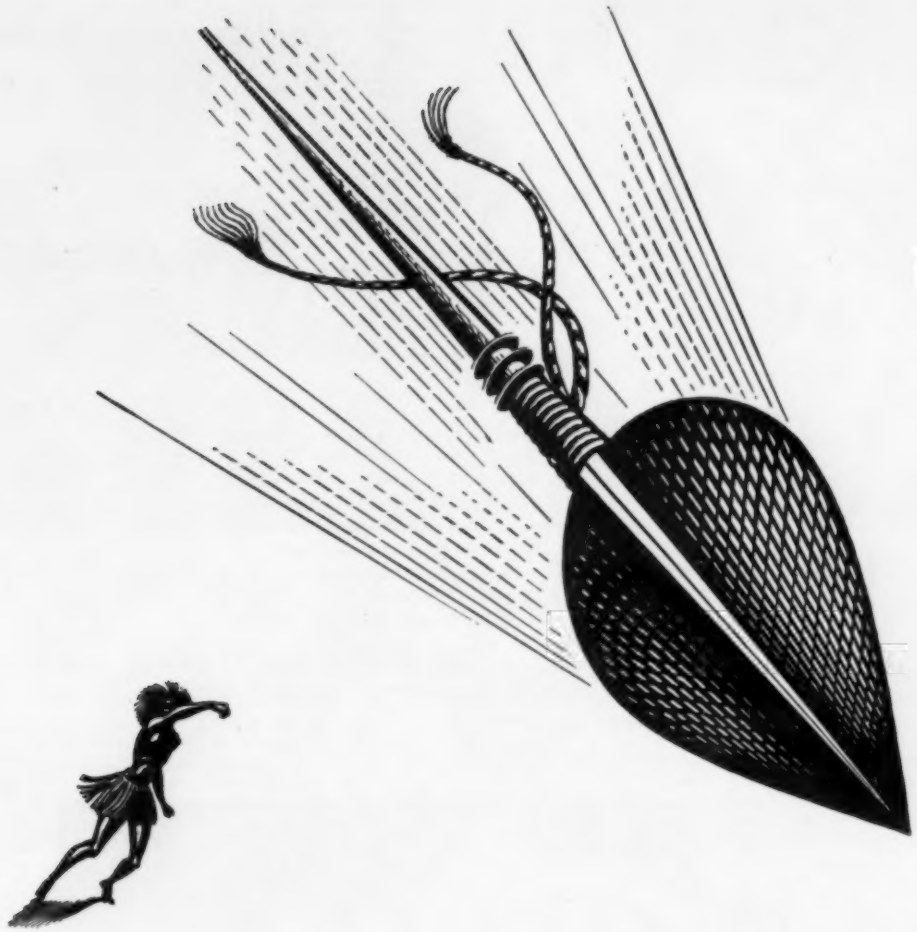
But hunting of this kind calls for special experience both in piloting and in navigation. Much of the territory over which the aircraft operate is uninhabited, unknown, viciously broken and subject to violent storms and to temperatures of "60 below." The pilot must be capable of turning suddenly when flying along a narrow valley, and coming in over a running wolf at exactly the right height and angle—"a little to one side and no more than 30ft above your target"—to allow the gunner to bowl it over. The spread effect of a shotgun offers a better chance of scoring a hit than would a bullet from a rifle. But the range of a 12-bore is limited, and it takes not only a sure touch but a modicum of nerve to come down low enough to bring the target within the gunner's range, especially in "grey weather" when the white of the sky and of the snow-clad tundra merge; and judging the distance between one's skis and the ground is a matter of guesswork.

Aircrew must also be of ready imagination, as indeed they are—witness the report filed at Umiat by the previously mentioned gunner, Maurice ("Prop-Shot") Kelly, and told to me in the Eskimo settlement of Kotzebue. Firing at a pure white wolf, Kelly shot four inches off the end of the airscrew. The Piper was flying in extremely broken country. But the pilot, bush-flyer Buck Harris (with a Van Dyke beard and a stop-at-nothing reputation) brought his machine down, carved four inches off the undamaged blade, took off again and made a supply dump some 200 miles to the west, where the spares available included an airscrew.

The standard drill is to reconnoitre for wolf trails at from 500 to 1,000ft, the exact height depending on visibility and the country being swept. On spotting a trail the pilot descends to 50ft or so (again, depending on the terrain). Often it is only a few minutes before the gunner is firing out of his window; and where the target proves to be a pack the pilot turns and repeats his run as often as necessary.

There is a ready market for wolf skins and, where possible, the pilot puts down near a dead animal. To land even a light aircraft on snow-clad tundra, or in broken country, calls for delicate handling, quick thinking and an ability to "read" snow surfaces—that is, to judge distances and heights and correctly interpret shadows caused by rock outcrops, mushy ice and other hazards. But there are pitfalls against which there is no safeguard—such, for example, as that which caused the previously named Frank Glazer an anxious moment.

He and his pilot had turned for base, after killing a pack



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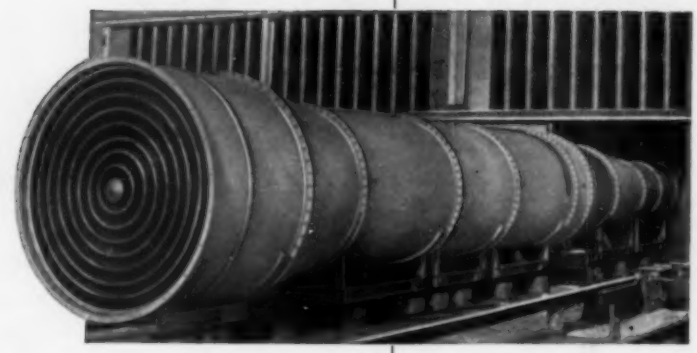

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Top: Photograph of air intakes and Detuner in test beds for testing Armstrong Siddeley Sapphire engines at the works of Brockworth Eng. Co. Ltd.

Left: Office with Acousti-Celotex ceiling; by courtesy of Frigidaire.

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D12

(Left) Death in the snow: The Piper Cub has just put down alongside a dual kill; one wolf's trail, made before he was stopped in his tracks, can be seen leading from the vegetation in the background. (Right) Pilot Harris beside his Piper with a shot wolf; the skins are worth money, so the animals are retrieved whenever it is possible for the aircraft to alight.

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of nine wolves in nine runs, when Glazer saw a black wolf running along a mountain ledge. The pelt of a black wolf can be worth £15 and more. It was therefore understandable that the pilot, after bringing his Piper round in a tight turn so that Glazer could kill the animal, should repeat the turn, land on the ledge and taxi up to the carcase. "The snow looked O.K. from the air," Glazer told me. "But it had been weakened by the trampling of caribou and it collapsed under the Piper's weight." The aircraft ran forward in an involuntary take-off just as Glazer was about to clamber aboard again. This left him the alternative of dodging the tailplane or of diving into the passenger seat head-first. He accepted the latter, and in the process of disentangling himself from a nine-foot wolf skin he lost one glove and suffered a frostbitten hand.

Temperatures in the neighbourhood of Umiat were around minus 30 deg F last March, and forty below the previous March. But the 1952 wolf sweep from this airstrip coincided with a cold spell. The mercury fell to sixty-two below (F). Pilots and gunners wore heavy U.S.A.F. parkas over several layers of wool, down-filled outer-trousers over wool, knee-length fur boots with several pairs of stockings, and three pairs of gloves. Even so, there were several cases of frostbite, and others of engines freezing-up and rubber splitting.

Extreme cold is often accompanied by frost haze, and the area of Umiat is also liable to fog and sudden and violent blizzards. But in spite of such difficulties and hazards seven wolves were killed on the first day of the last wolf sweep; and at the end of three weeks the figure stood at 161. After that the daily bag fell off. The wolves, becoming shy of aircraft, were taking to the mountains, where flying conditions were even worse than in the flat, barren tundras.

And the debit side? One Piper Cub written off in an emergency landing and two aircraft damaged and repaired "in the field."

Wolves have been hunted from the air in Norway, Sweden, Finland, the Soviet Union, the Balkans and Turkey. Some time ago the Canadians mounted a major campaign against the wolf, from the ground and the air (after wolves had killed so many caribou that the R.C.A.F. had to fly food to some Eskimo settlements); and there is no safety in Alaska for wolves that cross the border from Arctic Canada.

A NEW LONG-DISTANCE TRANSMITTER

DESCRIBED as the first unit-built ("channelized") transmitter of such power to be built by a British firm, new 1kW equipment for long-distance ground-to-air communication is announced by Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Known as the GFT.60, the equipment operates on fixed frequencies in the range 1.5 to 30 mc/s. Multi-frequency working is readily achieved by using combinations of three basic units, the r.f., modulator and power-supply cabinets. Any r.f. unit may be instantly brought into circuit, thus making for rapid and reliable channel switching.

The GFT.560, which is fully tropicalized, is designed to run unattended if so required, and additional units are available which permit remote control of all functions, including channel switching, *via* a two-wire telephone circuit; circuit adjustments are signalled to the transmitter on the ordinary telephone dial.

The unit construction permits subsequent expansion of a basic installation by the addition of r.f. units, modulators, and perhaps power units, one of which can supply two r.f. units for simultaneous cw operation.

In addition to its use for H.F. *en route* ground-to-air R/T. the CFT.560 may be employed in point-to-point circuits in R/T.; here its ability to handle single-sideband and independent-sideband signals is of importance.

BIG ORDER FOR AIRFIELD TRACTORS

A CONTRACT worth some £250,000 has been awarded by the Ministry of Supply to David Brown Tractors (Engineering), Ltd., of Meltham, Yorkshire, for the supply of tractors and spares to the Royal Air Force. Delivery of the vehicles has already begun.

The contract covers two standard types of David Brown tractor, the 30 1C and the VIG/1C, both of which will be used for aircraft towing and general airfield duties.

Both machines are powered by a four-cylinder David Brown petrol engine of 3¾in bore and 4in stroke, with ratings of 26.5 drawbar h.p. and 30.6 belt h.p. (both at 1,600 r.p.m.), with 41 brake h.p. at 2,300 r.p.m. Drawbar pull of the 30 1C, which can be increased by 20 per cent by the addition of ballast and a change in the final drive ratio, is 3,700 lb in first gear; for the VIG/1C the figure is 7,000 lb, making the vehicle capable of handling the largest aircraft now in service.

Both tractors, state the makers, are already in extensive use for military, naval and civil aircraft duties in many parts of the world. In addition to its R.A.F. rôle the 30 1C is in service with the Fleet Air Arm, the R.C.A.F., and the Danish and Belgian Air Forces. It is also in use by several well-known airlines, including B.O.A.C. The VIG/1C is operating with the R.A.A.F., R.C.A.F., R.N.Z.A.F., and on commercial airfields with B.O.A.C., the Kuwait Oil Company, and Shell Petroleum.

EIGHT BELLS

New Anti-Submarine Aircraft for the F.A.A.

The Bell HSL-1 has a fuselage much smaller than its engine would support, for shipboard stowage is a requirement and the 4,000 lb of stores occupy little bulk. No doubt a transport version would be bigger.

EARLIER this year it was announced that eight Bell HSL-1 hunter/killer anti-submarine helicopters would shortly be supplied to the Royal Navy under the terms of the Mutual Defense Assistance Program. These are the first rotary-wing aircraft ever designed for this job (later examples will be the Sikorsky HSS-1 and modified Bristol 173) and an analysis of their development follows.

Most of the navies of the world have been devoting great efforts towards solving the problems of anti-submarine warfare, and, right in the midst of their plans, the helicopter is showing itself capable of doing at least as much as can a fixed-wing aircraft or surface vessel—probably more.

The U.S. Navy put out an A.S.W. helicopter specification at the proper time (1950), of which the winners were the Bell Aircraft Corporation. The political situation of the time was such that, possibly for the first time in history, the research and development contract and the production contract for the HSL helicopter were issued simultaneously. This programme reaped its reward on March 4th last year for, when the prototype XHSL-1 first flew on that date, a full production line of HSLs was in being in the new Fort Worth factory.

The HSL is a rather curious machine, with a narrow, flat-sided fuselage supported at each end by a big two-blade rotor, which folds for shipboard stowage and follows former Bell practice in having a stabilizer bar at the hub. As the lower photograph shows, the front rotor bearing is bolted to the top of a large conical tube, which is attached to the main keel member at its lower end and is laterally braced to the front bulkhead; this tube thus occupies much of the front of the cockpit. The two rotors are driven from a single Pratt and Whitney R-2800-50 18-cylinder radial engine *via* a linking and transmission shaft lying along the roof of the fuselage. The engine installation swings to starboard, as shown, and a shrouded fan draws in cooling air from the louvres seen beside the central tail fin. This engine, which is also used in the S-56, has a one-hour rating of 1,900 h.p.

One of the major problems to be faced in using A.S.W. helicopters is that of crew fatigue during long periods of ocean search in all weathers, which is far more arduous than anything done with rotary-wing aircraft so far. Bell have designed their own autopilot to fill this need, and its characteristics have been matched with the requirements of dunking sonar (sonobuoy) apparatus. The system is, in conception, simple.

Pitch and roll are stabilized conventionally by a vertical gyro and a rate gyro in combination. The unique feature is that it is the helicopter control system, and not the fuselage, which is stabilized. This permits rapid variations in c.g. (as might follow the dropping of heavy weapons) without effect on flight path and without the need for any re-trimming. Pilot control of the pitch and roll channels is accomplished by simple manual movement of the cyclic-pitch stick.

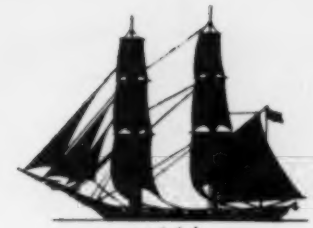
Directional heading is controlled by a G-2 gyro compass integrated with the autopilot. Changes in heading can be made in two ways. In hovering flight, the HSL can be yawed by the application of pedal pressure, the pedal force governing the rate of yaw. In forward flight, an automatically co-ordinated turn can be made by depressing a button on the cyclic stick and establishing the desired angle of bank with stick movement. Once on the new heading, the pilot recovers from the turn and re-engagement of the button ensures that the new course will be maintained.

Collective pitch, and thus altitude, in forward flight is maintained by a pressure-sensing servo which varies collective pitch as a function of pressure altitude related to reference altitude. At any time, the pilot can override any commands or displacements imposed by the autopilot simply by applying a moderate force to the primary controls; this is made possible by slip clutches between the servos and the system.

This control system has required over two years' intensive research, and much of the flying was done with a Bell H-12. In particular, many features were entirely novel, and thus there was no previous experience on which to build. The success of the system may soon be judged by pilots of the Fleet Air Arm, who should have eight Bells in a few weeks.

In the Fort Worth plant lines of production HSL-1s are seen to be progressing. The simple undercarriage is noteworthy, as is the method of pivoting the Double Wasp engine.

Air Power at Sea



H.M.S. HERMES

The name *Hermes* for a warship goes back to 1796 when a brig-rigged sloop of 14 guns was captured from the Dutch as the Mercurius, and then re-named. The first aircraft carrier to bear the name served the Fleet Air Arm through its formative years and well into the second world war.

The new 20,000 ton Intermediate Fleet Carrier *Hermes* is of the new class equipped with 'angled deck' and steam catapult—these British inventions being the most important modern developments in deck flying. As with her predecessor, Fairey aircraft will be with the Fleet operating from the new *Hermes*.

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FAIREY

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The Royal Air Force.

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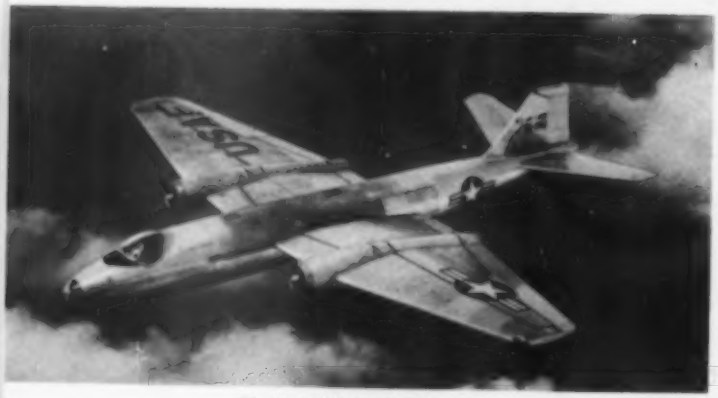

The United States Air Force.

The Venezuelan Air Force.

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- ★ **Holder of 13 World Records.**
- ★ **In production in 3 countries.**

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ROLLS-ROYCE AVON JET ENGINES

M. Roger Druine standing before the Turbulent (of which he is the designer), outside the Hurel-Dubois hangar at Villacoublay. The neatness of the Volkswagen installation is seen below.

FLIGHT "In the Air" Impressions

French Lightweights

Druine Turbulent and Sipa Minijet - - By C. M. LAMBERT

DURING a recent visit to France, I gladly took the opportunity—offered by M. Noetinger, of the Union Syndicale des Industries Aéronautiques—of flying a number of French light aircraft. Only in France could one find in the space of three days such a variety of light aeroplanes to fly; yet, though I was kept fully occupied, I no more than nibbled at the large collection of types to be seen everywhere.

Two of the aircraft I flew were the Druine Turbulent and the Sipa 200 Minijet. The Turbulent, designed by M. Roger Druine, is truly an ultra-light, with a span of only 6 m 55 cm (21ft 6in), and a length of 5 m 25 cm (17ft 3in). A single-seat low-wing monoplane with fixed undercarriage and tailskid, it is powered by a 25 h.p. Volkswagen air-cooled car engine fitted with dual ignition and a two-bladed wooden airscrew. The Turbulent runs on 73-octane or premium car petrol, consuming 7.5 litres (1.7 gal) an hour whilst cruising, and has an extreme endurance of three hours.

It is extremely simple, having neither trim lever, flaps, brakes, throttle friction nut, nor any electrical services. It is not aerobatic, but it is so simple to fly that pupils who have reached first solo standard on, for example, a Stampe, can make their first solo on the Turbulent—and often do so, if one is available, to save money.

I flew Turbulent F-PGYQ, which belongs to the designer and is kept in the Hurel-Dubois experimental hangar at the Villacoublay subsidiary airfield. It was this airfield which gave rise to some misgivings, because take-off direction, from the grass, had to be parallel with that of Villacoublay main runway, a few hundred yards to the south. I therefore had to take off down a westerly wind of some 20-25 km/hr (14-16 kt) in extremely bumpy weather. I expected a good deal of trouble from bumps and thermals over woods and hangars and was told that, because of the proximity of the Orly circuit, I should not go above 200 m (650ft)—and, because of turbulence, not below the same altitude!

I watched M. Vidal, Hurel-Dubois chief test engineer, fly the Turbulent round the airfield and then prepared to fly it myself. I climbed into the cockpit, fastened the lap-strap, lowered a pair of borrowed goggles and listened while M. Druine bent down and explained the cockpit to me. There were six instruments, from left to right: A.S.I. (km/hr), insensitive altimeter (metres), magnetic compass, rev counter, and V.S.I. (m/sec). A ball-type slip indicator (below the compass), a magneto switch, throttle, stick and pedals completed the appointments.

I was told to cruise at 2,600 r.p.m. (maximum 2,800) and that was all. The airscrew was swung, and I taxied carefully out, picking my path between molehills. The cockpit is just large enough, the view in all directions excellent and, although the undercarriage is a little hard, directional control is all that one could desire with the engine set at 1,600 r.p.m. The rudder is then effective and the speed over the ground about 4 m.p.h.

I had to taxi almost a mile to reach the end of the grass runway. Next to an unoccupied caravan with a wind-sock pointing straight up the runway I performed some Vital Actions. There was in fact nothing to do but (on this occasion) to turn the aircraft down-wind. I opened the throttle and it accelerated smoothly without any appreciable swing. The tail came up after 40 or 50 yd and after about 200 yd I flew the Turbulent off. I was immediately assailed by a series of sharp bumps and climbed away carefully, avoiding a hangar roof only to hit a violent bump over a road. But the little aeroplane rode the bumps well without any tendency to "fall out of one's hands." An aircraft of this size is naturally greatly affected by turbulence, but the Turbulent is eminently manageable under such conditions. The cockpit was quite warm and only one's shoulders and forehead were exposed to a gentle slipstream. At 2,600 r.p.m. the speed built up to 110 km/hr (60 kt) indicated (120 km/hr, or 66 kt, actual). Stick forces are very light and although depending on the amount of fuel and the weight of the pilot, the trim will vary, the effect is never enough to cause any discomfort. There is a large P.E. on the A.S.I. and 16.5 kt indicated is about 27 kt actual.

I tried a slow run at 35 km/hr (19 kt) indicated with the nose well up and, into wind, almost succeeded in hovering relative to the ground. There was no decrease in control effectiveness and, on opening the throttle, cruising speed was rapidly regained. I next tried to turn the aircraft by taking my hands off the stick and holding one arm out sideways. This resulted in a slight yaw but no change in lateral attitude. One felt very free and cool; this would be the ideal occupation on a hot summer's day.

Next I tried a stall. This is quite remarkable. I cut the power, held the nose a little way above the horizon, and waited. At no more than 28 km/hr (15.3 kt) indicated the Turbulent nodded sharply forward without dropping a wing; immediately the nose fell below the horizon the speed rose to just below 40 km/hr (22 kt) and, being then unstalled, the nose came up again with the stick still held back. As it passed the horizon it stalled and nodded again—and so on for five or six stalls with the stick held back and without any sign of yaw or wing-drop. I tried it into wind and cross-wind with exactly the same results. The Turbulent simply "went downstairs" like a well-behaved child in a strange house. These characteristics are probably due to slotted ailerons and leading-edge slots forward of them, and to a very smooth plywood-covered wing leading edge.

I had to make the approach down-wind over a wood which was causing some vicious bumps. I settled down with a trickle of power at 70 km/hr (38 kt); despite the following wind, the angle of approach was quite steep and I had no difficulty in touching down by the caravan. It required very little round-out and there was not much float, and at no time did one lose a good view ahead over the nose. The landing run was about 150 yd.

This is an aircraft designed to be built by amateurs with no more than a reasonable knowledge of carpentry. Complete plans are on sale in France for 5,000 francs, and the materials can be bought from several firms there. The main difficulty lies

This view of the Turbulent being flown "hands off" in formation demonstrates its stability and tractability.

French Lightweights . . .

in the engine—the Volkswagen is recognized in France but not abroad. (M. Druine intends to fit a 44 h.p. Lutetia vee-four and to fly his Turbulent over to England for the Coventry meeting on June 18th and 19th). So far, 126 sets of plans have been sold all over the world and more than 20 Turbulents have been completed in France. M. Druine calculates that the materials cost about £150, the engine about £90, and that 800 man hours are required for construction. For the aircraft which results this is very little to pay.

SIPA 200 MINIJET

THE Minijet is one of a series of excellent light aircraft designed by M. Gardan since the war. I made a very short flight with Max Fischl, SIPA test pilot, who was checking the oil consumption of the 330-lb thrust Turboméca Palas—during aerobatics the previous day it had proved to be excessive.

One's first impression of the Minijet must be its minuteness. Although its extreme height is given as 6ft, the wings are at waist level, the cabin roof very little higher, and the underside of the fuselage just a few inches clear of the ground. We flew from Villacoublay main airfield in a cross-wind of some 20 kt, and on the ground the aircraft had to be supported under the tail-skid to prevent its being blown down on to the tail booms.

This was the second prototype, whose fins and rudders are very slightly modified; the original Y control-column has been replaced by two separate sticks, and a full blind-flying panel is now installed, although horizon and turn-and-bank indicator were not working on this occasion. All instruments are on a vertical panel, and flap, undercarriage, fuel and trim controls and indicators are on a console down the centre of the cockpit, between the two pilots. The interior is finished in grey-blue.

To climb in, one ducks under the open roof panel and then wriggles down and back into the seat. Once in, there is just enough room for elbows and plenty for the legs. The view is reasonable over the instrument panel, good to the sides and poor everywhere behind the three to nine o'clock sectors.

When we had fastened the excellent five-point seat harness, M. Fischl started up; he selected petrol on, oil on, pressed the starter for two seconds, then further pressed the igniter button and at 10,000 revs released these two buttons, switched to kerosine, and opened the throttle. We taxied out fast at about 25,000 revs, using toe-operated hydraulic brakes for steering. The noise is distinctive but neither loud nor penetrating. The suspension is excellent, being extremely smooth and quiet. The oleos are the product of a new French company which also made those for the Potez 75.

At the marshalling point we made the usual checks, pumped down 15 deg of flap and opened up to 35,000 revs against the brakes. Despite the fact that we needed a lot of brake to keep straight initially in the cross-wind, the acceleration was smooth and the take-off short for a jet aircraft—about 400 yd. By the time we had pumped the undercarriage up, the speed had built up from 70 to 100 kt and we climbed away at between 200 and 300 m/min (990 ft/min).

M. Fischl then let me take the controls. I found them light, very responsive and well harmonized. As on most jet aircraft, the rudder was a little soggy; but there was no need to use it—a normal turn was carried out with stick alone and a fairly high angle of bank. There was the usual slight difficulty in aligning

Sipa test pilot Max Fischl gives scale to the Minijet at Villacoublay. In the background are Sipa 121 trainers.
"Flight" photograph

Another air-to-air view of the Turbulent. M. J. Noetinger of the French S.B.A.C. (U.S.I.A.) is seen at the controls.

We bowled along the perimeter track and I tried taxying, but a gust of wind caught us under the starboard wing and with full opposite brake and rudder the Minijet lurched firmly on to its port mainwheel door, causing slight damage. This was soon repaired after we had taxied in; but although the excessive lurch was found to be due to a slightly deflated oleo, it does seem that the Minijet is almost uncomfortably close to the ground—certainly too close for rough grass.

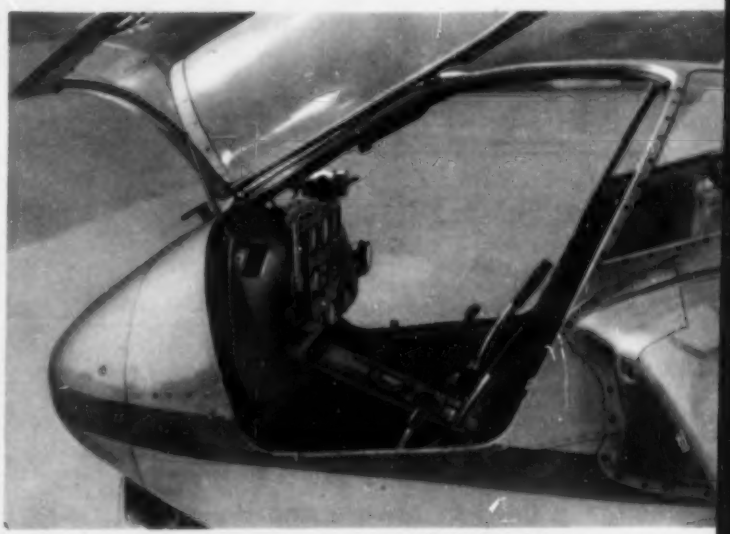
There are certain qualities peculiar to jet aircraft which it is very hard to define, but one felt at once that the Minijet had them. Yet with these qualities it has genuine light-aircraft performance. It stalls at about 50 kt, cruises at 150 kt at 1,500ft at 31,500 r.p.m., and climbs at almost 1,500 ft/min. Although there is nothing "hot" about it, it does behave like a jet aircraft, and I cannot see that it would be suitable for the average Sunday-afternoon flyer. It is, however, a delightful and satisfying machine, and I was most sorry not to be able to spend longer with it.

Besides the two prototypes, a pre-production batch of five has been ordered by the French Government Secretariat for Light and Sporting Aviation. Furthermore, NATO training authorities have shown interest in the Minijet as a possible basic trainer. It will be interesting to watch further developments of the Minijet, and in the meantime we hear that the Sipa 300, a tandem two-seat single-jet trainer, is soon to be built.

the nose on the horizon. The Minijet gives that sense of freedom which is a characteristic of jet aircraft, and one hears only the noise of the air being drawn into the wing-root intake close to one's shoulder, and seems to float effortlessly through the air. Despite its responsiveness, the Minijet is not in the least what the French call "nervous," and it can be trimmed to fly hands off almost indefinitely. Having only 180 jet hours (all on Meteors) with which to compare the Minijet, I must admit that I found the latter infinitely more responsive, with a far greater rate of roll, though this is only to be expected of so light an aircraft.

The second prototype Minijet, unlike the first prototype, is fully aerobatic at its take-off weight of 1,675 lb; but since for this flight we could not apply any negative g, because of the oil system, I was unable to try any aerobatics. M. Fischl, however, executed an immaculate slow roll (maintaining positive g) which showed how responsive the aircraft is.

The oil pressure now began to drop and we returned to Villacoublay. On the down-wind leg, M. Fischl pumped down the undercarriage and 15 deg of flap. These flaps are double-slotted but so arranged that, when retracted, both slots are shrouded by the wing under-skin. There seemed to be no difficulty in getting the speed down, and the approach was neither too shallow, too steep nor too fast—about 80 kt. The flap selector was left "down" and one full stroke of the pump lowered 5 deg of flap. Maintaining constant power, M. Fischl applied extra flap as required down to some 30 deg. More than this is available but is never required. Round-out and touch-down produced no great change of attitude, and the nosewheel was put down immediately. The ensuing ground run was about the same as that for take-off.



"Flight" photograph

The views of the Minijet above and below show the cockpit from eye-level. The double slotted flaps are illustrated in the fully extended position.

Mediterranean Air Cruise

Comfort all the Way on Aquila's Flying-boat Service to Capri

"Flight" photograph

Arrival: the Capri coastline is silhouetted against the afternoon sunlight as Aquila's Solent begins a circuit of the island.

BLUE water became a frothy white as our Solent skimmed across the Mediterranean near the rocky coast of Capri. We alighted at 5.2 p.m. on May 21st after a six-hour direct flight from Southampton—the first airline passengers ever to arrive at this enchanted island. The occasion was the proving flight for the regular Aquila Airways service due to start yesterday. Between now and September it will be possible to fly to Capri in 8¼ hr elapsed time, which includes a traffic stop at Marseilles. During July, the peak month, there will be one round trip weekly.

This is unashamedly a de luxe service, for which the flying-boat is the ideal vehicle. Aquila's flights to Madeira, the Canary Islands and now Capri are probably the most luxurious scheduled airline services operated today. The company's present fleet consists of two 42-seat Solents and three 31-seat Hythes. As these aircraft are neither pressurized nor turbine-powered, their popularity is impressive proof of the flying-boat's unique passenger-appeal. Interior spaciousness is undoubtedly its main attraction. Throughout the flight the passenger is completely free to wander about the aircraft at will, and this freedom fosters the sociable atmosphere normally encountered only aboard ship.

As shown by the cabin plan reproduced overleaf, the Solent has three separate cabins on two decks, plus a bar/observation-cabin which will comfortably accommodate more than a dozen people. In addition, it is liberally equipped with toilets and dressing-rooms. The cabin crew—two stewardesses and two stewards—have far more space in which to prepare and serve meals than have their counterparts in any landplane of comparable size. And the control cabin, occupying the forward half of the upper deck, is the least restricted we have ever seen. Well-separated stations for two pilots, navigator, radio officer and engineer, together with a large rest bunk, occupy a space sufficient for at least three times as many passengers.

Solent G-ANAJ *City of Funchal*, the aircraft which made the Capri proving flight, is actually a converted R.A.F. Seaford. Although commissioned in 1945 (at Felixstowe, where it flew with the Marine Aircraft Experimental Establishment), it had logged only about 200 hours when acquired by Aquila last year. Overhaul and conversion to luxury standards were performed by the airline's engineering staff at Hamble. The work took about six months, and no effort was spared to produce an air yacht of most un-military appearance.

We embarked in *City of Funchal* at 10.53 a.m. on Friday, May 21st, in company with 38 other passengers and a crew of eleven. The travellers included Capri's most renowned personality—Miss Gracie Fields, accompanied by her husband, Mr. Boris Alperovici. Our hosts were Sir Donald Henderson, chairman of the P. and O. Steam Navigation Co., which is now associated with Britavia, Ltd. (parent company of Silver City and Aquila); W/C. Barry Aikman, managing director of Aquila Airways; his chairman, Mr. E. C. Mekie; and co-director A. Cdre. G. J. Powell.

In command was Capt. Douglas Pearson, Aquila's chief pilot, who made the original proving flight for the company's first scheduled service—to Madeira—just five years ago. His crew, larger than usual in order to provide as many flying staff as possible with experience of the new route, was as follows: Capt. F. Simpson, 1st/Off K. Hammer, 2nd/Off D. Weetman, Rad/Off H. M. Bedford, Rad/Off J. Hoyle, Eng/Off Horan, Stewards H. B. O'Neill and R. Woodward and Stewardesses J. Evans and H. Lee.

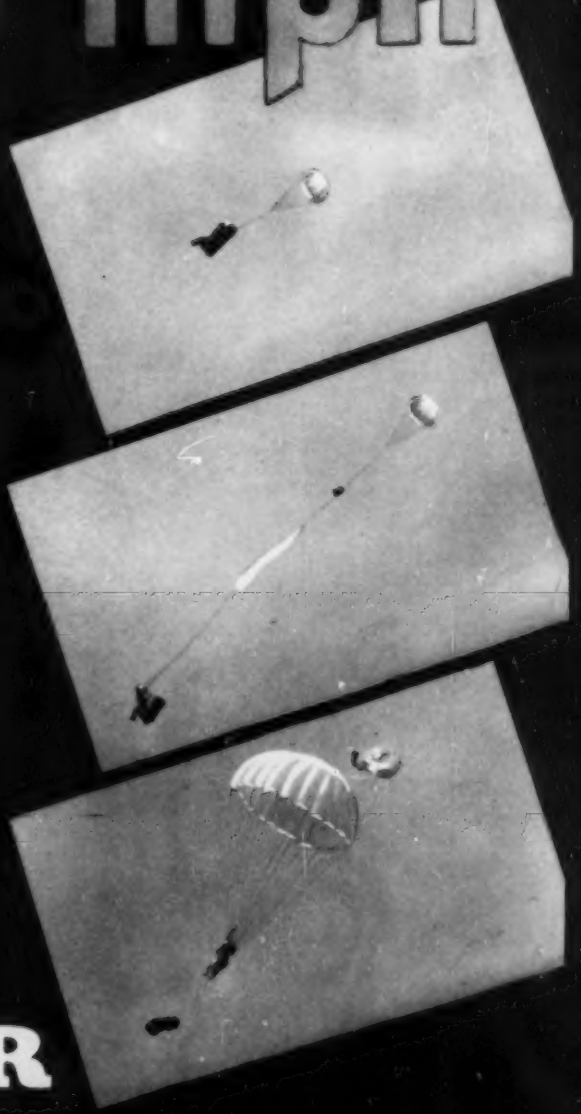
The outward flight was smooth and uneventful. We cruised at 9,500ft, passing occasionally through inoffensive puffs of cumulus, at a ground-speed of 210 m.p.h. and T.A.S. of 190-195 m.p.h., feeling not the slightest wish to cruise faster, higher or farther. Our route lay *via* Le Havre, Marseilles, and Elba, where we followed the Italian coastline to Naples. Capt. Pearson then let down to 500ft on the 195 leg of the Capodichino range, in order to test company procedure for a bad-weather approach to Capri across the Gulf of Naples. After a low circuit of the island the Solent alighted on the lee side of its precipitous coast, pitching a little in the swell. The flight had taken 5 hr 55 min—an average speed of 188 m.p.h. Twelve minutes later *City of Funchal* lay moored on the blue Mediterranean off the little harbour of Grande Marina.

Launches loaded with Italian photographers and newsreel cameramen made circles of foam around the flying-boat, and when Gracie and Boris disembarked the flash-bulbs went on flashing for at least five minutes. The arrival of Capri's first

Departure: "City of Funchal" takes off from Southampton Water. The non-stop proving flight to Capri took a little under six hours.

at low altitudes each second is vital

150 ft. 600 mph



On the 17th March, 1954, an ejection in straight level flight was made from a Meteor 7 aircraft with the Martin-Baker Patent fully Automatic Ejection Seat.

- The speed 600 m.p.h., the height only 150 feet.
- One second after ejection, drogue developed holding seat steady and slowing it down.
- Three seconds after ejection, parachute fully developed with 80 feet in hand.

Patented in the principal countries of the world and certain patents pending.

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COMMUNICATIONS

With full service radio and equipment a crew of 2 and 8 passengers range 575 miles (925 kms.) cruising at 172 m.p.h. (278 kms.p.h.) at 8,000ft (2,438 ms.).

FREIGHTING AND SUPPLIES

Quickly removable seats expose large cabin for bulky freight stowage. Main door opening 5ft. 2in. (1.57 ms.) x 4ft. 2in. (1.27 ms.) permits parachuting supplies.

AIR SURVEY

Vertical, oblique and forward facing oblique camera apertures, with fuel for 1,000 miles (1,609 kms.) range. Accurate photography from over 20,000ft (6,100 ms.).

Adapted also for six stretcher Ambulance, Navigation/Bombing training, long-range Ferrying and twin-engine Pilot Training.

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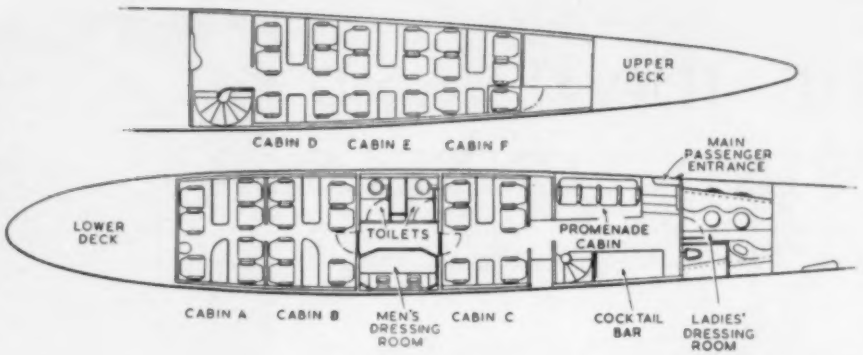


Flying-boat comfort: a familiar phrase is illustrated by these deck plans of the passenger cabins in Aquila Airways' Solents. Forty-two passengers can be accommodated, 38 in fully reclining seats and four in the lower-deck lounge bar.

MEDITERRANEAN AIR CRUISE . . .

airliner was front-page news in next day's Italian newspapers. Hundreds of the cheerful, olive-skinned residents of Capri were waiting to welcome the Solent's passengers as launches took them to the jetty. Their greeting, and the courtesy with which customs and immigration formalities were completed, were a foretaste of the hospitality offered to the Solent's passengers and crew during their weekend stay. The pace was set by the taxi-drivers (each capable of holding his own against Ascari or Farina at Monza) who sped the guests to hotels along Capri's steep, zig-zag roads.

Most of the Capri service ground-work—if such a term can be applied to a flying-boat route—has been performed by Aquila's operations manager, Mr. R. J. Clark, who had arrived at the island the previous day to prepare for the Solent's arrival. During an earlier visit, in February, he had surveyed the area and found it suitable for the proposed service. Mr. Clark's responsibilities included the establishment of let-down and communications procedures, and the selection of alternative alighting points (Nisida and Lake Bracciano). Aquila's weather minima for Capri will be two miles visibility and 500ft cloud-base; as the service operates only from June to September the probability of diversion is small.

Southampton-Marseilles-Capri: Schedules and Fares

Outward:				
dep. Southampton	0900 hr	arr. Marseilles		1300 hr
dep. Marseilles	1430 hr	arr. Capri		1745 hr
Inward				
dep Capri	0915 hr	arr Marseilles		1230 hr
dep. Marseilles	1400 hr	arr. Southampton		1800 hr

Aircraft leave Southampton each Thursday (except June 10th and 24th) and return from Capri each Friday (except June 11th and 25th).

	Single fare	Return fare
Southampton-Capri	£37	£66 12s
Southampton-Marseilles	£17	£30 12s
Marseilles-Capri	£20	£36

The need for costly mooring and handling facilities, which must often be paid for by only one operator, is sometimes used as an argument against the flying-boat. While this may be true of large-scale, high-frequency services, there was no hint of complexity in handling arrangements for the Capri flight. The average time spent waterborne by passengers at each point of arrival and departure was about nine minutes, which compares very favourably with the amount of time spent in embarking, engine starting, taxying and waiting for take-off clearance at land airports. So far as cost is concerned it would be unwise to generalize. Aquila's successful and highly efficient services depend on the selection of a route where marine aircraft can offer the best—perhaps the only—service, and on keeping overhead costs at a minimum.

At Capri, for example, the company will be represented (and for the duration of the traffic season only) by a single employee. His duties will include the observation of weather conditions and sea swell for transmission to the airline's base at Hamble and, by way of the air-traffic control centres, to pilots *en route* to Capri. He will also be responsible for maintaining contact with the Italian civil aviation authorities and with B.E.A.'s representative at Naples (who will be in charge of passenger handling), and for the charter of launches when a service is due. The fire tender is provided by the Italian Government, which has also spent 3m lire (about £1,725) on three mooring buoys with seven-ton sinkers. The fact that Aquila's alighting fee will be only £5 per arrival shows keen local appreciation of the additional tourist trade which the service will bring.

Aquila's aircraft will not normally refuel at Capri. Sufficient fuel will be taken on at Marignane, Marseilles, for the flight to and from the island. The alighting fee at this combined air-sea terminal is in the region of £15. Refuelling is not a complicated process, since the Solent is moored within 50 yd of the landing stage and the hose is carried by launch from one of the tankers normally used to refuel landplanes at Marignane. Air Algérie are responsible for passenger handling.

Mr. Clark, who copes with many of Aquila's traffic problems as well as being in charge of operations, stresses the importance of using reliable local agents where possible. Admittedly, Aquila operate on a small scale, but such cost consciousness might improve the economic results of many larger concerns. We emphasize the point because we feel that airline economics are not a cut-and-dried process based on the operational characteristics of a particular aircraft type. Economically, existing types of flying-boat can be a very marginal proposition; yet, with the backing of an enthusiastic staff, Aquila's managing director, Mr. Barry Aikman, has kept a door open for the future. R. B.

"Flight" photographs

(Above) Marignane, Marseilles, will be a traffic stop on the regular service to Capri. During the return proving flight, the S.E. 200 was observed—minus its six engines—at this air-sea terminal. A visit to the Canzone del Mare (below), the swimming pool and restaurant owned by Miss Gracie Fields, is a "must" for every holidaymaker in Capri.

DE HAVILLAND WIND TUNNELS

Two Valuable Research Aids at Hatfield

PRIOR to 1939, the research capacity of the aircraft industry was very modest. As far as aerodynamic investigations were concerned, the picture was roughly as follows: initial testing of the simpler kind was generally possible in very small slow-speed tunnels of the sort employed for instructional purposes; modifications to existing aircraft were invariably proved in full-scale flight trials; tests that required a proper experimental wind tunnel were invariably done at one of the tunnels of the R.A.E., Farnborough, or—in earlier years—at the N.P.L.

This picture still held fairly true in 1945, although the R.A.E. tunnels had been (by peace-time standards) severely overloaded during the war. At this time, not only was an era of prosperity anticipated, but the turbojet had opened up the whole field of transonic aerodynamics, and greatly increased research facilities began to be planned. The S.B.A.C. formed a committee to advise firms upon the optimum forms of tunnel, in an effort at obtaining some standardization, so that companies could share, or exchange, models. Today, most of the larger British aircraft constructors have their own wind tunnels, or are members of the A.R.A. group for whom a very useful tunnel is nearing completion in Bedfordshire (*Flight*, February 12th last).

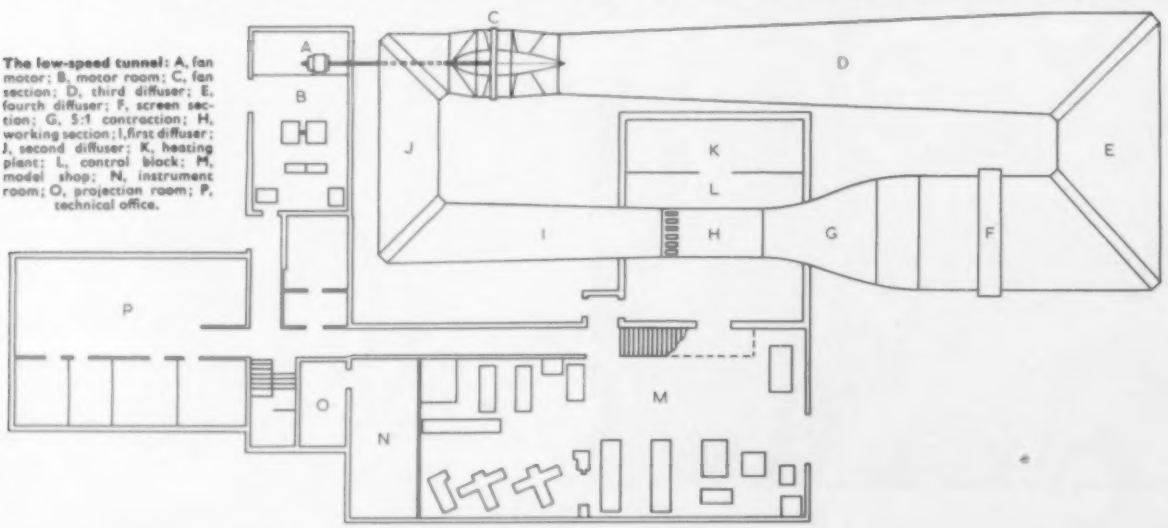
The great de Havilland enterprise has recently completed two wind tunnels, which have been designed, built and run in some 20 months. They occupy a site on the far side of Hatfield airfield, belonging to (and surrounded by buildings of) the de Havilland Propeller Co., Ltd. Both tunnels are supported by a self-contained organization which includes a model-making shop, instrument room (for preparation of strain gauges, Schlieren equipment, and the like), a drawing office and other facilities. The two tunnels are shown in diagrammatic form on these pages, and are discussed below.

The High-Speed Tunnel. — Although compressor-driven tunnels are cheaper to run, it is generally agreed that the turbojet-powered, injection-type tunnel is much quicker and cheaper to build, and the latter type is finding wide acceptance where a fair-sized tunnel is required capable of operation at Mach numbers greater than unity. The de Havilland tunnel took shape in 1952, and its capital cost was reduced, at no expense in operating efficiency, by employing Ghost engines from the prototype Comet G-ALVG, and by converting the already-existing low-speed tunnel of the propeller company as a housing for the "hot" side of the installation.

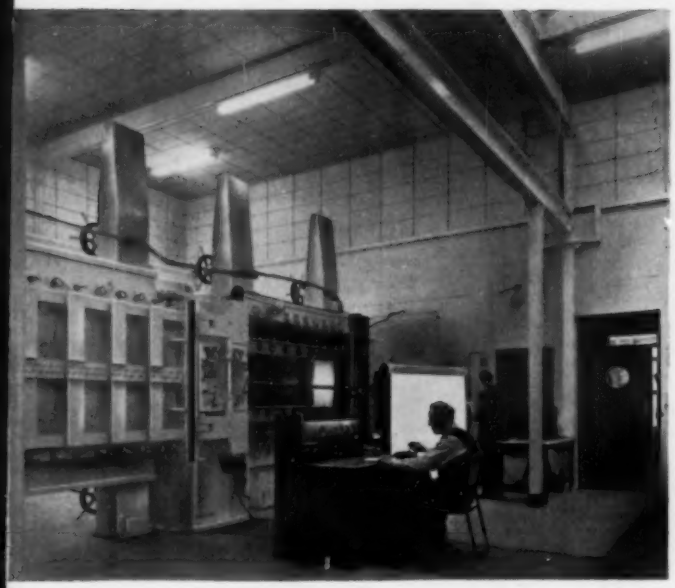
The instruction to proceed with actual design came on June 6th, 1952. Extensive theoretical investigation followed, backed-up by one-eighth-scale testing of the injector section and final diffuser, using compressed air from the gas dynamics laboratory of the D.H. Engine Co., Ltd., passed through a Ghost combustion chamber to simulate representative conditions. Five configurations of nozzle were tested over a range of mass flows and pressure ratios, that finally selected having an area ratio of 0.6.

With the exception of the working section, the contract for the construction of the tunnel was placed with G. A. Harvey and Co. (London), Ltd., of Greenwich. They were able to start on the detail drawings in mid-January of last year; the first part of the tunnel structure was delivered to the site on August 15th and erection then proceeded as prefabricated sections were delivered. The working section, shown in the photograph opposite, is a massive assembly held to an extremely fine tolerance. Its manufacture was entrusted to Foster, Yates and Thom, Ltd., of Blackburn. The major design-features were settled one year ago, main fabrication started last August, the working section was delivered on November 23rd and a fortnight later erection on site was complete—a remarkable achievement.

As the tunnel is adjacent to the Propeller Company's buildings, soundproofing was important. The engines and exhaust side were housed, as noted above, in the concrete tunnel formerly used as an airscrew test-bed, a proportion of the original silencing being used to admit the engine intake air. For the hot exhaust,



The low-speed tunnel: A, fan motor; B, motor room; C, fan section; D, third diffuser; E, fourth diffuser; F, screen section; G, 5:1 contraction; H, working section; I, first diffuser; J, second diffuser; K, heating plant; L, control block; M, model shop; N, instrument room; O, projection room; P, technical office.



The three Ghosts (left) inject into a section which, like the rest of the tunnel, is made of ¾in steel plate generously reinforced; nevertheless, vibration has made imperative the welding-on of all constructional nuts. The working section (above) has upper and lower liners of fixed profile which can be hinged about their upstream ends to assist in setting up and obtaining the correct gap; this also takes care of any manufacturing inaccuracies and, further, makes possible some variation in Mach number—say, from 1.55 to 1.65.

a new heat-resistant building was erected inside the outlet of the concrete tunnel, incorporating splitter panels designed and made by Cementation (Muffelite), Ltd., of Victoria St., London, S.W.1. These panels were inserted between the initial engine runs on March 1st and the running of the tunnel on March 26th. After negotiating the splitters the efflux is diverted upwards by an 8ft brick wall.

The de Havilland company readily acknowledges the "whole-hearted co-operation which these firms, and others concerned, gave in the design and construction." All three engines were run up to full power, with the working section by-passed, on March 1st; air was drawn through the working section on the 26th of that month and the tunnel is now about to begin full operation. The following is an account of the path of the air from the tunnel intake to the exhaust.

The airstream induced in the working section is taken through the intake silencing building, which houses acoustic splitters to prevent the noise travelling back from the engines when the tunnel is running at subsonic speeds. Leaving this silencing chamber, the air meets the splitter section, where it mixes with the recirculated hot gases from the exhausts. It then passes through two stainless-steel screens, the first serving as a filter to trap the larger impurities, the other reducing turbulence. Afterwards the air passes through a 15ft-long settling chamber before going into the contraction cone, which has overall area ratios of about 15:1 for M=0.8 to M=1.4, and 20:1 for M=1.6.

Leaving the fixed contraction, the flow passes through the working section proper, which consists of three parts. The first is the model position; the second houses the sting support strut and incidence adjusting-gear for the model; and the third forms the transition to the first diffuser. The whole working section is sufficiently robust to withstand the high inward loads without deflection.

The removable side-walls of the working section are 8ft long and 4ft high, and form the vertical surfaces swept by the airstream. The width of the working section is 2ft, but allowance is made for an increase to 2ft 6in if required in the future. The ceiling and floor are formed by liners which fit flush with the fixed contraction upstream and are attached by means of two screw-jacks each, thus permitting the liners to be set at any desired angle to suit the test. This feature is unusual; most high-speed or supersonic tunnels have fixed liner-positions. The rapid adjustment is extremely useful, as it permits easy and precise correction for the thickening of the boundary-layer along the working section, and also, at supersonic speed, allows testing at a small range of Mach numbers on each side of the design value. There are three sets of liners to cover the range from M=0.8 to M=1.6

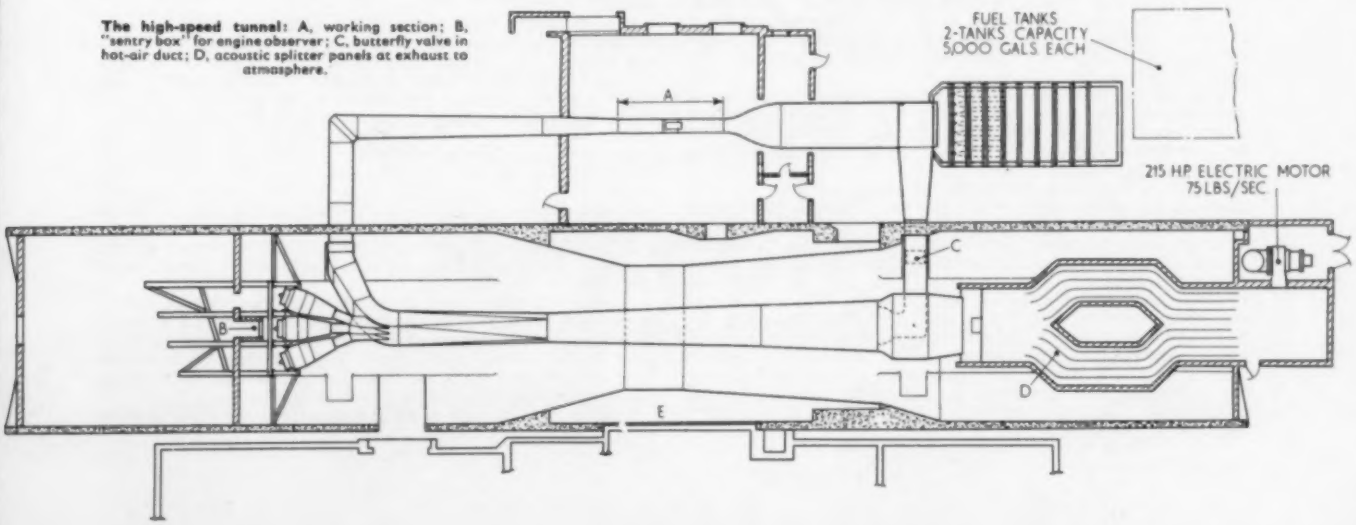
In the side walls, opposite the model position, are optical-glass windows of 20in diameter, through which the formation and position of shock-waves at high Mach numbers can be seen by the use of Schlieren apparatus. In the centre section (where the incidence measuring-gear is fixed) and rear section the ceiling and floor are also formed of liners adjustable in height and angle like the forward liners; they give a wide choice of initial angle of the first diffuser.

After leaving the working section the air passes through the first diffuser, of 3.5:1 area ratio, giving an equivalent cone angle of 3.5 deg; takes a right-angle bend with the aid of thin turning-vanes; and then sweeps upwards towards the engines, the section being reduced to the required area at the jet nozzles.

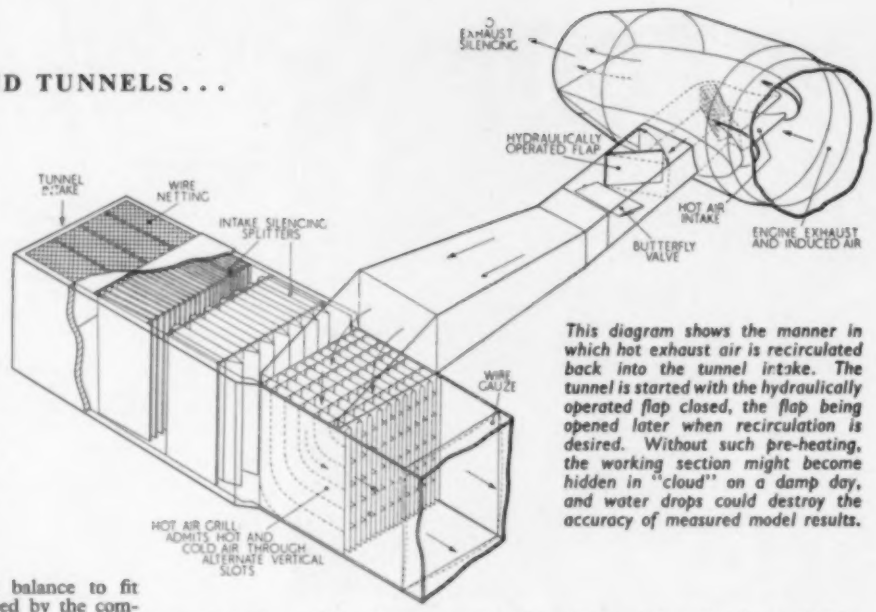
The motive power for the tunnel is provided by three de Havilland Ghost 50 turbojets, arranged to exhaust into the tunnel and induce the airflow through the working section—the principle of operation is illustrated by two familiar laboratory items: (a) the air-suction pump driven by tap-water and (b) the Bunsen burner, in which combustion air is induced by the gas jet. The installation of the Ghosts appears rather irregular, but it is the optimum compromise between the conflicting needs of short engine tailpipes, efficient flow mixing and easy vertical removal of any engine without disturbing the others. As regards operation of the engines, no legal restriction applies; in the interests of longevity, they are not run above 9,750 r.p.m., the former "maximum continuous" rating. The fuel is ordinary kerosine, fed from the main underground store to a 600-gal gravity tank equipped with Comet booster pumps. The starting and control system reflects standard Comet practice, the "pedestal" looking much as that of a three-engined Comet would.

The airstream from the working section is mixed with the exhaust from the engines in a constant area-duct sufficiently long to provide efficient mixing, and afterwards the mixture enters the final diffuser (of 4:1 area ratio and 4 deg to 5 deg cone angle) before the final duct. Across this final section is a large aerofoil with a leading-edge intake in which a certain proportion of hot gases is collected, turned through 90 deg by means of cascades, and ducted into the splitters, where it mixes with the incoming cold air. This increases the temperature of the air in the working section so as to avoid condensation in the air over the model. Up to a maximum of 15 per cent of the exhaust mass-

The high-speed tunnel: A, working section; B, "sentry box" for engine observer; C, butterfly valve in hot-air duct; D, acoustic splitter panels at exhaust to atmosphere.



DE HAVILLAND WIND TUNNELS . . .



This diagram shows the manner in which hot exhaust air is recirculated back into the tunnel intake. The tunnel is started with the hydraulically operated flap closed, the flap being opened later when recirculation is desired. Without such pre-heating, the working section might become hidden in "cloud" on a damp day, and water drops could destroy the accuracy of measured model results.

flow can thus be circulated to avoid condensation at the highest tunnel speeds. In this form of tunnel the cost of drying equipment as normally used on closed-circuit high-speed tunnels would be prohibitive.

The model is attached by a rear sting supported from a vertical strut passing right through the working section. An ingenious gearing system has been devised so that the model can be rotated about its c.g. position by a combination of angular displacement of the model sting and vertical displacement of the main support strut.

All the loads on the model will be measured by means of strain-gauges. A six-component balance to fit inside the model has been designed by the company's instrument laboratory, using Baldwin strain-gauges and Elliott recorders. This balance is now in process of construction and development. The instrument laboratory will be responsible for all the instrumentation on both high- and low-speed tunnels.

The Low-Speed Tunnel.—The design of the low-speed tunnel is based on that of the "industry tunnels" recommended by the S.B.A.C. committee set up after the war. This recommendation called for an efficient tunnel of moderate proportions to do most of the aerodynamic tests required during the design of a new project. Two sizes were suggested, a 13ft × 9ft structure capable of speeds up to 300 ft/sec and a smaller and more economical version with a 9ft × 7ft working section for speeds up to 200 ft/sec.

After due consideration of the range of Reynolds Numbers required and the economics of the system, it was decided to erect a 9ft × 7ft tunnel driven by a 500 h.p. motor and capable of speeds up to 250 ft/sec. During the design stages several modifications were made to the original "industry tunnel." The order for the main structure was placed with G. A. Harvey and Co. (London), Ltd., on November 24th, 1952, at the same time as that for the high-speed tunnel; but, because of the higher priority of the other project, design work on the low-speed tunnel did not start immediately. With the larger size of the sections, it was decided that, unlike the high-speed tunnel, most of the work would be done on site at Hatfield.

The first frames were delivered on October 20th, 1953, and from then on the erection proceeded at a good rate. All the welding was completed by May 1954, and the structure, together with the screen, fan fairing, cascades, etc., was completed by the end of May, seven months after the first material was delivered on site.

The working section, where the model is placed, is 18.5ft long, 8.7ft wide and 6.7ft high, with corner fillets. This working section is made of 1in-thick plywood supported by stiffeners and is the work of Flexo Plywood Industries, Ltd. Two large windows give a full view of the model during the test, and one of these windows is incorporated in a large door which can be removed to allow the model to be taken directly into the working section.

Leaving the working section, the airstream passes into the first diffuser (equivalent cone angle, 3.3 deg) before the first corner cascade; the cascade vanes are made of ¼-in plate with the appropriate curvature and enable the flow to make a 90-deg bend with the minimum losses.

A short section leads to the second corner cascade, which is identical, except in height, with the first. Through this second set of vanes passes the shaft which drives the fan immediately downstream of the corner, in a section which has been increased in size in order to keep constant the airstream area around the tapered fan-fairing.

After the fan section is the main diffuser, 87ft long and of 4:1 area ratio (equivalent cone angle, 4.4 deg), leading to the third and fourth corner cascades, which are of thin galvanized-steel sheets reinforced by horizontal slats. Provision is made to fit two screens in the section downstream of the fourth corner, but at present only one screen is used. This screen, 17ft high and 22ft long, has been woven as a single unit by G. A. Harvey and Co. (London), Ltd.

After the screen there is a short settling chamber and then the 5 to 1 contraction cone which speeds up the air before it enters the working section.

The 12ft-diameter, four-bladed fan, made by the Airscrew Co. and Jicwood, Ltd., is driven directly by a 500 h.p. D.C. motor. This motor is fed from the high tension A.C. main by a motor-generator set. Provision is made for the motor to be controlled from a desk situated near the working section and an interesting electronic control system permits the speed to be kept within very fine limits. All the electrical gear has been designed and manufactured by the British Thomson-Houston Co., Ltd.

Above the working section is erected a six-component virtual-centre balance designed and manufactured by Test Equipment, Ltd., of Crawley. It is the latest of a series which they have developed from the N.P.L. Warden balance; but it is the first designed to read all six components simultaneously. This has necessitated adding two extra steelyards and a take-out mechanism to prevent interference between some of the components.

Although the balance separates the six components mechanically, the forces and moments are balanced by means of electric steelyards operated from the control desk. The readings are transmitted through Dessyns and can be read directly from the desk. The model incidence and angle of yaw can also be altered and recorded from the desk.

FOR CONTROLLING TAPPED AIR

A NEW series of diaphragm reducing-valves for the control of air bled from gas-turbine compressors is announced by the aircraft division of the Hymatic Engineering Co., Ltd., Redditch, Worcs.

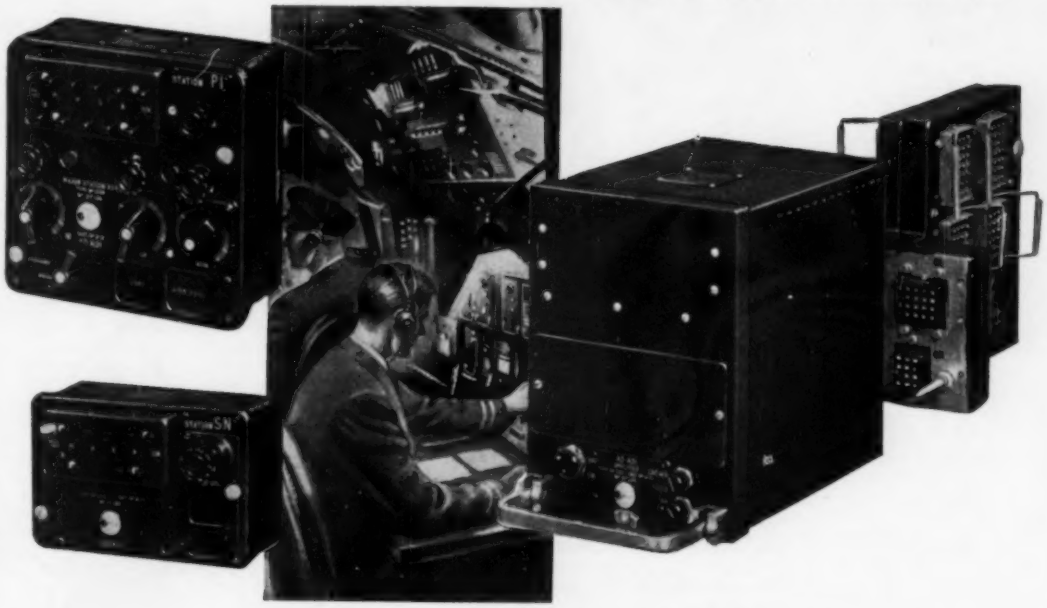
Known as the PS45 series and designed primarily for controlling for fuel-tank and recuperator pressurization, the valves will handle inlet pressures varying between 20 and 150 lb/sq in within a temperature range of 40 deg C to 150 deg C. The reduced outlet pressures are adjustable up to 50 lb/sq in and can be held between plus and minus 0.5 lb/sq in from the nominal setting for flows up to 12 cu ft/min. On current engines, it is stated, this performance is sufficient to enable the recuperator to supply both the normal fuel system and the reheat at the same time.

Constructed mainly of light alloys, the PS45 balances air pressure on a diaphragm against an adjustable spring load. A datum connection is provided in the bottom cover of the valve so that, if it is found desirable to control the output low-pressure in relation to a datum other than ambient conditions, it may be piped to a "false ambient" source.

An integral relief valve, set to blow off at a pressure slightly in excess of the maximum reduced pressure, provides a discharge outlet from the recuperator and prevents the risk of excessive pressure-rise in the unlikely event of the reducing valve sticking fully open; it also spills the slight leakage through the reducing valve when there is no low-pressure demand.

Measuring 6¾ in high × 2⅞ in wide overall, the PS45 reducing valve weighs 1 lb 2 oz.

Aircraft Intercommunication



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CRC 253

FOR SPEEDING PRODUCTION

Advantages of Mechanical Handling to be Demonstrated at Exhibition and Convention

ON Wednesday next, June 9th, the Parliamentary Secretary to the Ministry of Supply, Mr. A. R. W. Low, is to open the fourth Mechanical Handling Exhibition and Convention at Olympia, London. Among the speakers at the inaugural luncheon (under the chairmanship of Mr. C. E. Wallis, chairman and managing director of Associated Iliffe Press, Ltd.), will be Sir Miles Thomas, chairman of B.O.A.C.

There will be 200 exhibitors, and some 75 per cent of their equipment will be seen working; installations which would be too large for the building will be shown in working-model form. A great deal of the equipment—particularly fork-lift trucks, tractors and certain types of mobile cranes and assembly-shop conveyors—will be of considerable interest to aircraft production engineers and also to airline operators. For a detailed guide to what will be on show, we commend readers to the June issue of *Mechanical Handling*, now on sale; this is greatly enlarged special Show Preview number.

Manufacturers of mechanical handling equipment are most important contributors to Britain's export effort; of the £60 millions worth of such products estimated to have been made in British factories last year, over 25 per cent went to countries abroad. On the occasion of the last Mechanical Handling Exhibition, two years ago, visitors came from 36 countries; this year there have been applications for tickets from 45 countries.

Concurrently with the exhibition a convention is being held, at which papers will be read by specialists in various branches of mechanical handling. Among the papers likely to be of interest to the aircraft industry, with the dates and times at which they will be given, are the following:—

Work Study and the Materials Handling Engineer, by C. G. Chantrill (June 10th, 2.30 p.m.); *Heavy-type Mobile Cranes*, by A. Hallsworth (2.30 p.m., June 11th); *Bridging the Handling Gap*, by John Bright (June 12th, 11 a.m.); open forum, *In Search of Better Handling*—"any questions" answered by a team of experts (June 12th, 2.30 p.m.); *Belt Conveyors: Application of all Types to Mechanical Handling*, by T. R. Mackie June 14th, 11 a.m.); *Some Unusual Handling Problems*, by R. L. Sauvée (June 14th, 2.30 p.m.); *Economics of Modern Materials Handling with Industrial Trucks*, by R. G. Winton (June 16th, 2.30 p.m.); *Safe Use of Fork-lift Trucks in Industry*, by A. C. Cooper (June 18th, 11 a.m.); *Process Mechanization with the Aid of Spiral Conveyors*, by J. M. Beskine (June 18th, 2.30 p.m.).

The exhibition remains open from June 9th to 19th (Sunday excepted). The hours are from 10 a.m. to 6 p.m. except on the 14th and 17th, when the show will remain open until 9 p.m. for the convenience of works personnel. Admission is free for trade visitors, who should write to the organizers (*Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1) for season tickets giving admission to both the exhibition and the convention. Trade union members will be admitted on production of their cards. Public admission is 2s 6d.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Avoiding Cu-nim

WE have read with interest Capt. W. M. Anderson's article on "Turbulence in Cu-nim" [*Flight*, May 28th], and—as you suggest in your editorial footnote—are in a position to bring the airborne radar equipment story up to date. The operational results on the early equipment were sufficiently satisfactory to warrant the Ministry of Supply sponsoring the development with my company of a more refined equipment with a roll-and-pitch stabilization scanner, P.P.I. presentation, etc.

The essential characteristics of this equipment are: Output power, 10 kW; beam width, 6 deg; range of scan, plus or minus 75 deg about the dead-ahead position, with provision for tilting the plane of scan plus or minus 10 deg in the vertical plane (the scanning axis is stabilized in roll and pitch to plus or minus 45 deg and plus or minus 10 deg respectively); maximum display range, 40 miles; weight, less generators, cables, etc., approximately 170 lb.

This equipment was subject to trials carried out by B.O.A.C. on behalf of the M.C.A. during 1948. The results of these trials were given in two privately circulated B.O.A.C. reports, and were summarized in a paper on *Search Radar for Civil Aircraft* read before the British Institution of Radio Engineers in 1952.

In general, these trials showed that airborne radar was capable of detecting cu-nim clouds up to the maximum range of 40 miles and provided a simple means of selecting a safe course through thunderstorm areas. In addition, considerable success was obtained with high-ground detection and avoidance, and map-painting was shown to be a valuable aid to navigation.

More recent experience has been obtained with equipment supplied to the R.C.A.F. and installed in their Comet aircraft. Flights in the Singapore area indicated that cu-nim detection was still satisfactory at high altitude, i.e., 35,000-40,000ft, and it is worth noting that, in some cases, tops of cu-nim formations exceeded 45,000ft. During all these trials the problem of rain clutter, mentioned in your contributor's article, has not been found to be serious.

It will be seen that the problem of providing a suitable equipment has not been neglected by the electronics industry and we would like to emphasize that such equipment is immediately available to interested airline operators.

Southend-on-Sea, Essex. A. W. MARTIN,
Technical Director, E. K. Cole, Ltd.

V.T.O. Air Transports?

AT the Gatwick inquiry, no one made the important point that the development of helicopters and of aircraft for vertical take-off and landing (V.T.O. aircraft), of the form recently publicized as having flown in America, will make Gatwick Airport redundant before completion. This applies to other large airfields.

It is widely agreed that helicopters will do most of the short-haul work, but the significance of flight trials of V.T.O. aircraft has not been so far appreciated. They will replace present-day aircraft and facilitate air transport. The requirements of safety, performance and economy necessitate their use.

Regarding safety requirements, it is well-known that the majority of accidents are caused because present-day aircraft cannot hover, and have to take off and land at high speed. They cannot hover because their power is very inefficiently transmitted at low speed. V.T.O. aircraft can hover because their power is transmitted efficiently at all speeds. Now that full-scale V.T.O. aircraft have flown, it is surely the responsibility of the Government to develop and produce them as quickly as possible so that people will no longer be subjected to unnecessary risks, and lives will be saved.

Of performance requirements, it is well known that landing and take-off considerations control the sizes of wings and tail surfaces of present-day aircraft. The large dimensions of these

CORRESPONDENCE . . .

surfaces limit the speed at which it is possible to operate, and some aircraft have almost reached the practical limit. The only way to achieve a reasonable step forward is to develop V.T.O. aircraft, which do not have to use their wings for landing and take-off, and have them the correct size for higher speeds and performance. Such small wings weigh less than large wings, and permit increases in payloads.

As to economy requirements, it is evident that, because V.T.O. aircraft have higher performance than present-day aircraft of similar power, they will be cheaper to operate. Also, ground installations for them will be of economical size, in or near to centres of population.

With such aircraft replacing buses, lorries, and other vehicles—and this will inevitably happen, because there is nothing to prevent it—another national problem, that of road congestion, will be alleviated, if not solved.

East Grinstead, Sussex. J. R. ANDERSON.

[V.T.O. aircraft are in such an early stage of development that our correspondent's views seem a little optimistic.—Ed.]

Rolls-Royce Nomenclature

WITH J. M. Bruce and H. F. King *Flight* is *par excellence* in aeronautical history. The only detracting feature of Mr. King's recent study of Rolls-Royce is that, as a commemorative history, it did not herald a series of such articles of which Rolls-Royce would have been an appropriate first.

A fact not generally known is that the "birds of prey" nomenclature was not adopted until late 1917, and that early Rolls-Royce engines were designated according to contemporary practice, i.e., the maker's name preceded by the brake-horse power of the initial model, followed by a qualifying mark number for subsequent variations. It was a misleading system, for, to quote but one example, the 250 Rolls-Royce Mk III was in fact delivering 284 b.h.p. The change to the new system led to some confusion; and, lest others be confounded (as I was) I append a conversion table:—

Old Designation	New Designation	Actual b.h.p.
250 Rolls-Royce Mk I	Eagle Series I	225
250 " " Mk II	" " II	266
250 " " Mk III	" " III	284
250 " " Mk IV	" " IV	284
275 " " Mk I	" " V	322
275 " " Mk II	" " VI	322
275 " " Mk III	" " VII	325
— — — — —	" " VIII	350
190 Rolls-Royce Mk I	Falcon Series I	190
190 " " Mk II	" " II	250
— — — — —	" " III	280

Sawston, Cambs. D. B. ROBERTSON.

Partial Power Failure

I READ with great interest your news item (May 14th, "From All Quarters"), *A Tudor Incident Explained*. It appears that Air Charter, Ltd., have come to the conclusion that a partial power failure was the initial cause of the aircraft getting out of control.

I was involved in a similar incident whilst on A/S. patrol off British Cochin, Southern India, on November 11th, 1942.

The aircraft, a D.H.86 (numbered AX 800) borrowed by the I.A.F.V.R. from Tata Airways for A/S. patrols and convoy escort duties, had two depth charges of 500 lb slung between the undercarriages. The machine, with a crew of four, was flying at 2,000ft at roughly 98 kt I.A.S. on a southerly course. Visibility was extremely good, with a light south-westerly wind of about 5 kt. There was not a cloud in sight, and no turbulence.

The captain, Sgt. Dent, R.N.Z.A.F., was with me at the navigator's table helping me to find out why my navigation had "gone all to pot"; I seemed to be ten degrees out on all my previous courses. Sgt. Harrison, R.A.F., the second pilot, was at the controls in the starboard seat.

At approximately 0900 hr the aircraft seemed to begin to turn sharply to starboard and at the same time put its nose down. I heard Harrison frantically call for help, saying that he could not hold or control the aircraft. Dent managed to reach his seat, and by that time I had been flung over the back of mine and was pinned to the floor by the force of the spin that had developed in a matter of seconds.

I could see both pilots standing on the port rudder pedals and heaving back on the control column with all their might, but with no effect. I then tried desperately to reach the levers which would put the depth charges on "safe"; the W/Op. was also trying to get up off the floor, but without result. I then saw Harrison whip back all four throttles. The aircraft immediately responded to the violent corrective measures by then in operation and gained level flight at about 200ft. Dent gingerly opened up the two outer engines and then the two inner and proceeded back to base. All the above incidents took place in a matter of seconds.

After landing Sgt. Harrison said that he had noticed no drop in engine revs or change in engine note, nor any change in the attitude of the aircraft prior to its entry into the spin. The trailing aerial was out at the time, and it was thought that it had somehow got tangled in the tail unit; but no damage was found.

We flew the aircraft back to Juhu, Bombay, where Tata Airways and the D.H. company had their servicing depot. The decision to fly to Juhu was taken because we knew what to do in case it happened again, provided we had plenty of height.

A thorough inspection was performed and the aircraft was found to be in first-class order. The conclusion reached was that there had been a partial power failure in the two starboard engines, but that it had happened too quickly to be detected.

Incidentally, my navigation was not so bad after all; a new air driven generator had been fitted, and had affected the compass to some 15 deg. We put up a "black" by not doing a compass-swing beforehand.

Grantham, Lincs. J. K. METCALFE.

Distinguished Camel

I HAVE just seen a copy of *Flight* dated April 2nd, with a picture of a Sopwith Camel, submitted by Mr. E. G. Ramsay, I saw this particular machine at Lympne in 1918. There was a brass plate on the dashboard stating that it was the 1,000th machine built by Ruston and Proctors of, I believe, Lincoln, and that was the reason for its colouring.

Camberley, Surrey. E. H. HOLMAN.

The Wrights—a Supposition

IT seems to me strange, and perhaps it has been remarked upon before, that the Wright brothers did not attempt to antedate Blériot's channel flight. The challenge was obvious enough (as it had been to Blanchard and Jeffries and to Captain Webb) without the incentive offered by the *Daily Mail* a month after the Wrights returned to America, and the prestige gained would have assisted the European Wright companies materially.

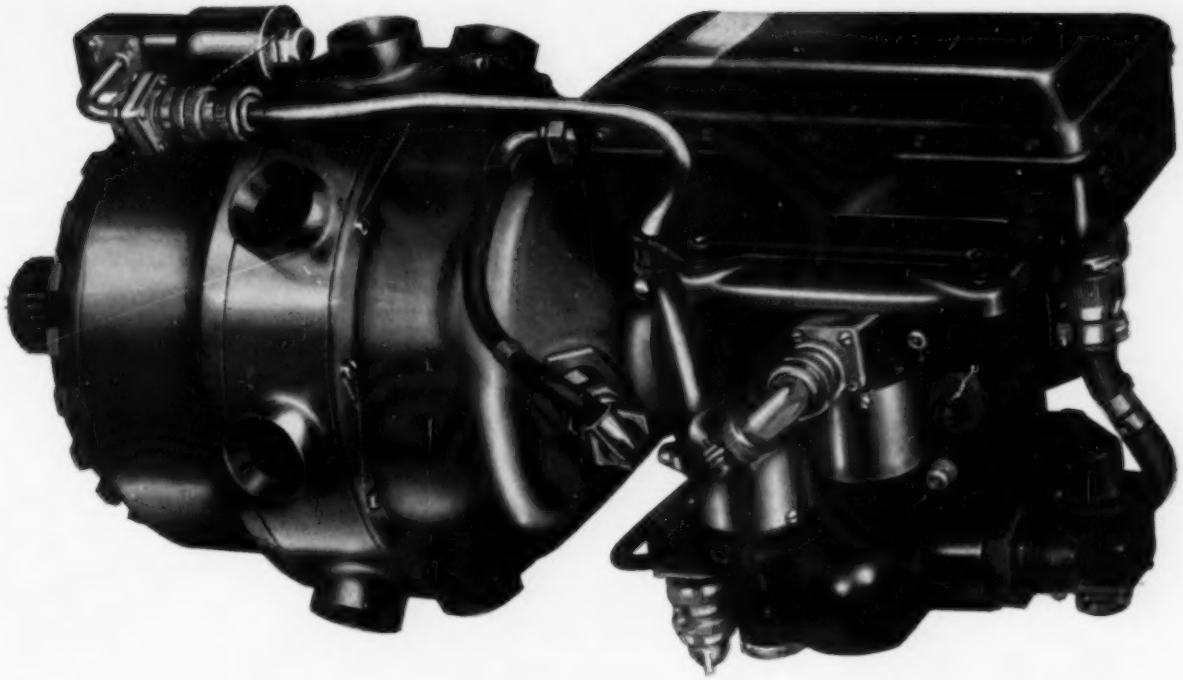
As to the means, the Wright aeroplane was superior to the Blériot; the Wright stayed in the air for two-and-a-third hours in December 1908, while the fan-type Anzani was unreliable.

If the "might-have-been" should be thought not to be in the cautious Wright tradition it should be remembered that in spring 1907 they were only prevented, by unforeseen events, from flying over the American Fleet at Hampton Roads in the interests of advertisement.

R.A.F., Moreton-in-Marsh. R. HING, Act. P/O.

FORTHCOMING EVENTS

June 5. Swansea and District Flying School and Club: Welsh Air Derby.
June 5-6. Niedersachen Section of Aero Club of Germany: International air rally, Hanover.
June 5-7. Dauphiné Aero Club: International Rally.
June 5-7. S.M.A.E.: British Championship and National Model Contests, Waterbeach.
June 6. Modena Aero Club: International aerobatic contest, Modena.
June 7. S.S.A.F.A.: Air display, Yeadon Aerodrome.
June 9-19. Mechanical Handling Exhibition and Convention, Olympia.
June 11-13. Royal Netherlands Aero Club: International air rally.
June 11-14. Palermo Aero Club: Sixth International air tour of Sicily.
June 12. Elstree Flying Club: "At Home."
June 13. Tangier Aero Club: Rally.
June 13. R.Ae.S. Garden Party, London Airport.
June 13-27. Polish Aero Club: International gliding competitions.
June 18-19. R.Ae.C.: National Air Races, Coventry Civic Aerodrome.
June 19. A.T.A. Association: A.G.M. and reunion, White Waltham.
June 19-20. Eighth air rally of the wines and chateaux of Anjou.
June 19-21. Aero Club of Savoie: Vermouth international rally, Chambéry.
June 20. Northamptonshire Aero Club: "At Home."
June 20. Northern Heights Model Flying Club: Gala Day, Langley Airfield.
June 21-24. Institute of the Aeronautical Sciences: Annual summer meeting, Los Angeles.
June 24-25. Women's air rally, Deauville.
June 26. Plymouth Air Display Committee: Air display.
June 26-27. Aero-Club de Fleurs de l'Orne: Normandie Rally.
June 27. Aero Clubs of France and Marseilles: International speed contest, Marseilles.
June 29. Milan Aero Club: Milan Grand Prix.
July 3. R.N.A.S. Eglinton: Air Day.
July 3. R.N.A.S. Bramcote: Air Day.
July 3-5. R.Ae.C. members' Deauville Rally.
July 3-5. Swiss watch rally, Bienne, Switzerland.
July 9. College of Aeronautics Students' Society: Annual presentation ball, Cranfield.
July 10. R.N.A.S. Lossiemouth: Air Day.
July 10-11. International Radio Controlled Models Society: Annual contests, Birmingham.
July 18. Yorkshire Aeroplane Club: "At Home," Sherburn-in-Elmet.
July 20-August 4. B.G.A.: World Gliding Contests, Gt. Hucklow.
July. 31 Ulster Flying Club: Newtownards rally.
Sept. 7-12. S.B.A.C. Farnborough display and exhibition.



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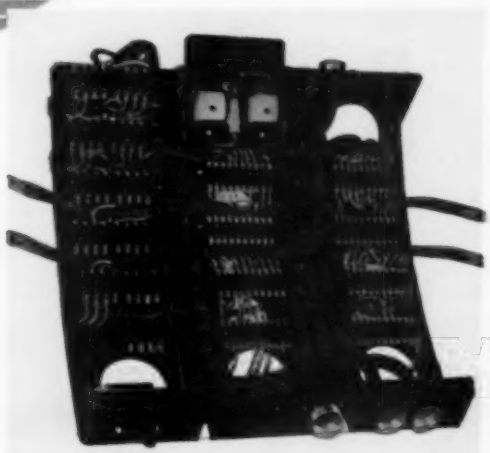

Electrical Supply Panel—Hawker "Hunter". A typical example of preformed wiring employing Plessey components. (Photographed by courtesy: Hawker Aircraft Ltd.)

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A 33

NEW AMERICAN TRANSPORTS

—and United States Reactions to the Comets

IT is safe to say that twelve months ago no one would have believed—much less have predicted—the existence of the present unhappy circumstances in which jet transports find themselves. To be precise, one airline man did tell us in Australia that "as soon as he saw the specification he knew the Comets were no good and would break up in the air," and he went on to say that "any jetliner weighing less than 200,000 lb and carrying a payload over a useful stage length would also fail. . . ."

The events of the last week or two make it likely that B.O.A.C.'s Comet 1s, now being used for exhaustive tests, will see no more service. On the other hand, the future of the 2s and the prototype 3—now ready to fly—are a different matter. And then there is the Boeing 707, which the Editor was privileged to examine in advance of its public appearance. Almost unbelievably it subsided on to its port-side pods during recent taxying trials and suffered quite serious damage. What this may mean in terms of undercarriage restressing or redesign we have yet to learn. Insurance claims are expected to amount to nearly $\frac{1}{2}$m, excluding any damage to engines which were not held covered. Certainly the company has suffered a most unfortunate reverse.

The friendly American sentiments regarding the Comet, recognized in our leader of April 23rd, were in fact manifest to the Editor during visits a month ago to the Douglas, Lockheed and Boeing plants. Talking to the designers, top engineers and to airline men in America as well, everywhere he met with sympathetic understanding and no suggestion of making capital out of the Comet setback.

The makers themselves were quick to point out that the DC-6 and Constellation both suffered long, expensive and worrying periods of grounding earlier in their careers. They indicated that one company's troubles, even if it is a rival, are their close concern too. They said that any help they could give would be freely forthcoming and they added their hope that an early answer would be found. There were no doubts as to the sincerity of these expressions of good will.

Many in Britain may be interested to learn that the publicity given to the second Rome disaster was restrained in America. One of the American companies told the Editor in confidence that it had gone so far as to set up a top-level committee of its own to study all information in case some possible solutions suggest themselves in the light of that company's immense experience of transport aircraft. In view of subsequent statements in the Press and the offer of help which has been made there can be no harm in mentioning now that this was the Douglas Company. The view was also expressed that the Comet mystery may have delayed Douglas's own plans by perhaps three months.

Naturally there was much surmise over there as to the cause or causes of the Comet troubles. Sabotage was scarcely considered. Engines—turbines to be precise—dropped from 50 per cent to no more than 10 per cent after the second loss. Kerosine explosion from one of several possible causes is high on the list and was being closely discussed. The belief that the centre section tank is of bag type—and all bags eventually suffer from seepage—has given this possibility prominence.

Again, the integral wing tanks are starting to have some clear air space at 25,000ft and the kerosine cools only slowly, and thus, it is pointed out, outside air temperature bears little relationship to the temperature of vapour at low pressure in the tanks. The envelope on a pressure temperature chart for kerosine shows the possibility of explosion at these sort of heights. American manufacturers, while appreciating calorific advantages of kerosine are as yet doubtful about its use in commercial aircraft. Military aircraft usually have an inert gas passed into tanks as they empty. The B-47, for example, has dry ice (solid CO_2) containers at the rear end of fuselage; around them are electric blankets which cause CO_2 discharge into the tanks when switched on as fuel is used.

What could cause a spark to set off an explosion? American engineers have considered electrical equipment as No. 1 possible cause—they believe the Comet's electrics might be at fault and stress the tremendous time and trouble they have had to spend on their own electrical systems with full isolation and safety in mind.

Another possibility is static. They wonder about Redux bonding of spanwise stringers in proximity to wing tanks. Apart from possible fuel vapour explosion, what is the effect of static or lightning discharge across Redux joints—could this have a bearing on the Calcutta accident, if not others? Finally, in view of past history of fuel-in-the-wing fires and explosions, and kerosine's ability to creep, can this be occurring or can fuel be overflowing during pressure re-fuelling in spite of checks and inspections? If this can happen, then some Americans think that buried engines also become a special danger.

Insufficient is known about tail and other structures for opinions to be expressed about their possible influence on the problem.

It may be added that the big manufacturers express little surprise that the troubles should have occurred after nearly two years' successful operation. Their experience has led them to expect troubles at various times well into the career of an aircraft after everything has thoroughly shaken down.

Another matter of which the Americans are obviously suspicious is the control system. Lack of manual (cable or rod) emergency system is thought wrong on a commercial aircraft and the type of feel and feed-back system is not favoured. It seems probable that like the Boeing 707 other American transports will have all-manual controls or have a manual alternative—even the B-52 bomber has manual controls with ordinary spring tabs. Strangely enough not much was said in the pod versus root controversy, nor was it held to be very important.

America's Plans and Progress

Now what of the plans and progress of the Boeing big three? There is no doubt that the 550 m.p.h. Boeing 707 has set Douglas and Lockheed a tremendous problem. There it is, an attractive and undoubtedly efficient prototype which was until the landing-gear mishap, ready to fly in a week's time. Nominally aimed at the military tanker market it is as well perhaps as much as 90 per cent civil airliner at the same time. It is said in America that physics control design just as much as civil or military duty these days.

In California some small comfort is being derived from past history which seems to show that those who waited a little longer and produced a slightly more efficient aircraft came out best in the end, and that a military prototype has in the past resulted in certain disadvantages in the civil derivative. The Boeing 247, earlier Stratoliner and Stratocruiser all came first, but were overhauled by DC-3, DC-4, Connie and DC-6. But Boeing should be wiser and more experienced today, so who can say that Douglas or Lockheed, starting later, can do better in the civil field. For the record let's add that taking into consideration the military orders for Stratocruisers (KC-97s), Boeing producing at the rate of one a day are ahead of all others in the class with a total of perhaps 550 to 600 built. Douglas DC-6 series (including 7s) are a close second, with just over 500 completed, and Lockheed Constellations not so far behind at third.

Above we state "Douglas *or* Lockheed can do better." It was intentional that the word "and" was not used. A small sum indicating probable total requirements of jet transports and the cost in America to design, develop and produce them, seems to indicate that if all three have a go, some one or even two are bound to burn their fingers—and this is discounting the competition of the 500 m.p.h. Comet 3 and the Vickers 1000.

Will there be much difference between the American three if they are all built? The answer must be no, for all will of necessity use four P. and W. J57s of 11,000 to 12,000 lb thrust. They will all have to be non-stop trans-Continental aircraft, and on the North Atlantic, non-stop one way and most of the time both ways. Capacity will also be much the same as requested by the airlines who are potential buyers. Six or seven years ago Douglas, it is learned, took a 500 m.p.h. jet transport design to show to several operators but received such a rough verbal handling that they hurriedly shelved it. Now the approach has come from the operators who want to talk of at least 550 m.p.h. for cruising.

In passing let us not overlook the big military turboprop transports for which a very important civil market may be found in the future—the Lockheed C-130, and the Douglas C-124 conversion and now the huge newly announced C-133. At present the makers are somewhat suspicious of their turboprop engines—with some justification no doubt—but feel that military requirements will bring about, and pay for, the development of good reliable American units in the near future.

Both Lockheed and Douglas have four-jet transport designs—worked out in considerable detail in each case, and with several variants. Any one would be ready on the word go. Both companies feel, however, that to discontinue their present aircraft (which are highly successful and make money for their operators) too early would be at least as bad as to start a bit late on the next ones.

Jet competition alone is to be feared and D.H., Boeing and later Vickers will try to give it. Because the Douglas DC-7 is in many quarters accepted as the best of the big compounded piston-engine transports at this time, Lockheed (who have also

(*Concluded on page* 741)

CIVIL AVIATION

SOUTHERN CONSTELLATION, now in service between Sydney and Vancouver, is the flagship of the Qantas Super Constellation fleet. The Australian airline has been asked to release earlier-type Constellation 749As to ease B.O.A.C.'s equipment difficulties.

THE VISCOUNT'S CENTURY

OFFICIALLY, the number of Vickers-Armstrongs Viscounts delivered or ordered at the time of writing was 93. However, two airlines—Central African Airways and Lineas Aeropostal Venezolana—have announced their intention to sign contracts for eight more Viscounts, bringing the total to 101. The L.A.V. announcement, made in Caracas on May 25th, said that three Viscounts would be bought, at a cost of more than £1,400,000 with spares, for service on Venezuelan domestic routes.

S.A.S. POLAR ROUTE APPROVED

UNITED STATES Government approval has been granted to the joint Danish, Norwegian and Swedish request to operate a trans-Polar air service terminating at Los Angeles. Subject to Canadian government approval for an application to pick up and set down traffic at Edmonton, S.A.S. hope to begin the service within 60 days. Several proving flights over the Polar route have already been made by the Scandinavian airline's DC-6Bs, which, in regular service, will carry 48 first-class passengers. Copenhagen will be the European terminal, and transit stops will be made at Söndre Strömfjord (Greenland) and Edmonton. These aircraft will carry a crew of nine, three of whom—on westbound flights—will leave the aircraft at Edmonton after completion of the Arctic leg.

HELICOPTER FERRY PLAN

APPARENTLY referring to the Fairey Rotodyne, A. Cdre. G. J. Powell, managing director of Silver City Airways, said last week that one British manufacturer, after study of the specification issued by his company, was able to build a car-ferry helicopter with a load and performance similar to those of conventional ferry aircraft. Such a development, having regard to the rotorplane's comparative immunity from weather problems and the shortness of the route, would represent an enormous step forward for the channel air ferry. Silver City Airways have applied to operate scheduled helicopter services, initially with single rotor machines and later with multi-engined types, over all their cross-Channel routes. Commenting on the application, A. Cdre. Powell said that the company realized that helicopter operations with payloads comparable with those carried on the present ferry services were not less than four years away, but that it was anxious to keep as up-to-date as possible with helicopter development.

Another application to operate scheduled helicopter services has been made by B.E.A., who intend to introduce their Bristol 171s to scheduled passenger services between London Airport and Eastleigh, Southampton, during the twelve-month period beginning on June 14th. A frequency of one to two services daily is envisaged.

GLOBETROTTING HERON

THE de Havilland company's prototype Heron 2, G-AMTS, recently returned to Hatfield after spending the winter months in a protracted demonstration tour which took it first to Germany and France, then *via* Tripoli, Algiers, Spain and Portugal, and all the way round the African Continent and then to India. On the European part of the tour the Heron met some of the cold weather which later assailed England, but soon it headed southwards for the sun, visiting Dakar, Liberia, the Belgian Congo, Southern Rhodesia, South Africa and Mozambique. Demonstrations were given in each of these regions and visits paid to those who were already using de Havilland aircraft there, particularly the Spanish company Iberia, who have operated Rapides from Fernando Po for the last 14 years. A number of operators of Beavers and Doves were also visited.

The Heron continued through Kenya, Ethiopia and Egypt to Jordan, where King Hussein piloted the aircraft. Next came the Persian Gulf and then India, where comprehensive performance demonstrations were given over several chosen routes. All these places provided ample opportunity for the Heron to justify its makers' claims regarding hot-weather, high-altitude and engine-out performance.

The Heron finally returned to the U.K. *via* Jordan, Cyprus, and Greece, where King Paul I of the Hellenes, an experienced pilot, took the controls for an hour. Further demonstrations were carried out at Urbe airport, Rome, before the return flight to Hatfield *via* Nice, Toussus (Paris) and Lympne.

Altogether, G-AMTS spent four months abroad, and flew more than 215 hours uneventfully. A number of routine maintenance inspections were carried out, several in fairly primitive conditions.

THE COMET INQUIRY

THE Parliamentary Secretary to the Minister of Transport and Civil Aviation, Mr. John Profumo, was asked in the House of Commons on Monday by Sir Robert Perkins (Con., Stroud and Thornbury) whether he would consider extending the terms of reference of the public inquiry into the Comet accidents at Elba and Naples. Sir Robert suggested that the inquiry should cover the previous accidents at Rome, Karachi, and Calcutta, and asked whether the British Air Line Pilots' Association would be permitted to give evidence. Mr. Profumo replied that each of these three accidents had already been investigated and that it was for the court to decide from which sources the evidence would be taken at the forthcoming inquiry.

In a further question Sir Robert said that the British Air Line Pilots' Association considered that in the case of the Rome accident the pilot, Captain Foote, was wrongly blamed; in this case the inquiry sat in private and no machinery existed for Capt. Foote to appeal or clear himself except to the court which had already convicted him. In view of the fact that since this accident there had been three changes in Comet take-off technique, Sir Robert asked, would the Minister institute a full public inquiry to enable this innocent man to clear himself? Mr. Profumo replied that the question of the amendment of the regulations was under consideration; if B.A.L.P.A. wished to take up this matter they could write to the Treasury solicitors.

A B.A.L.P.A. statement on this subject was issued as we went to press.

HELICOPTERS IN PARLIAMENT

HELICOPTERS were discussed during last week's House of Lords debate on Civil Air Estimates. Lord Douglas of Kirtleside said that he could not avoid the impression that there was a marked indifference in the minds of the Air Staff to the development of this type of aircraft. He was one of those who believed that in the next ten years all the shorter air routes up to 200 miles in this country and on the Continent would be flown by big multi-engined helicopters going in to the middle of cities. Fortunately, said Lord Douglas, the civil and military requirements of helicopters broadly coincided, so that the development of one assisted the other. There was no doubt that the development of the helicopter in this country was lagging and that we were being outstripped by the Americans; there was not enough pressure or sense of urgency behind helicopter development.

Lord Winster agreed that development of the helicopter "seems to have lagged a bit" and, in a reference to Lord Beaverbrook, said that he was delighted to see that a former Minister of Aircraft Production was lending his weight to popularizing the helicopter and pushing it forward.

For the Government, Lord De L'Isle and Dudley said that he shared the enthusiasm for the helicopter and regretted that we had been outstripped by the United States, which was, however, a very rich nation. He believed there were over 3,000 helicopters in the United States Army alone. Vast sums of money must have been poured into research and development; and, "being a highly efficient and technically skilled nation they get results." Lord De L'Isle and Dudley added: "I believe we shall gain a great deal if we build on their experience, coming perhaps rather late into the field, although I would remind the House that there is in existence the Bristol 173 which has been flying for two years

and has been under development for far longer." He did not think it was by any means certain that military and civil requirements would be the same—"although the principle may be there, the types may not be interchangeable."

Rotorplanes were also the subject of a series of questions in the House of Commons on Monday last. Mr. Norman Dodds (Lab., Dartford) asked the Minister of Supply if, in view of the necessity of giving greater impetus to the production of helicopters in this country, he would consider the setting up of an inter-departmental committee on which all the service and civil departments concerned would be represented. The Minister of Supply, Mr. Duncan Sandys, replied that if helicopter development was not progressing quite as fast as Mr. Dodds and he himself would like, he could assure him that it was not due to any shortage of committees. He did not think the progress in America was due to the multiplicity of committees.

In a further reply to Mr. Dodds, the Minister said it was still too early to give any reliable estimates as to when the 27-seat Bristol helicopter or the 40-seat Fairey helicopter would be available for passenger services. Mr. Dodds pointed out that the Sikorsky S-56 would be available in two years from now, but the Minister refused to be drawn on the subject of a possible order for this or any other type of American helicopter; but he did express the view that estimates of progress with the American aircraft were perhaps "a little over-optimistic."

B.E.A. TO BIARRITZ

KNOWN to private pilots for more than 30 years, the aerodrome at Biarritz has lately been developed into a £1½m modern international airport. As yet it is used by only one airline—British European Airways—but from July it will be included in the Air France network, and these companies will later be joined by Air Atlas-Air Maroc, Hunting-Clan and B.K.S.

The first scheduled transport to arrive at the new airport was the B.E.A. Admiral-class Viking G-AJBP *Sir Edward Spragge*, which, on April 11th, extended the existing Bordeaux service by flying on to Biarritz. Since then there have been two round trips weekly on the Northolt-Bordeaux-Biarritz route and on Friday last, May 28th, B.E.A. operated the first of two weekly direct flights to Biarritz. The aircraft concerned was, once again, *Sir Edward Spragge* (Capt. D. B. White, D.F.C.), and among its 25 passengers was a *Flight* representative.

We arrived [he writes] in brilliant sunshine within a split second of the advertised time—12.10 p.m. Behind us lay a pleasant 3hr 20 min journey from Northolt at 3,500ft—ahead a week-end of sight-seeing in the beautiful country of the Basque, and of excellent hospitality offered by the very air-minded tourist authorities in co-operation with B.E.A.'s station superintendent, Mr. Foster.

Biarritz and neighbouring towns are making a great drive to attract more British tourists to the area, and there is tremendous enthusiasm for the new B.E.A. service. Passengers and crew arriving on the first Viking to land at Biarritz were greeted by more than 3,000 residents, including the Mayor, and a party of Basque dancers and musicians.

The work of modernizing the *Aérodrome de Biarritz/Parme Côte Basque* began in September 1951, and had progressed sufficiently by January 5th this year to allow the airport to be opened to public air transport. There is a single concrete runway (4,922 by 148ft, with a magnetic bearing of 100/280 deg) and a bright, spacious passenger terminal. The restaurant, with excellent food and service, is open to the public, and is proving very popular despite the fact that there are at present only eight scheduled arrivals or departures weekly. The five-storey control tower is almost completed and is due to be opened next month. Radio aids consist of a non-directional beacon two miles from the airport and V.H.F. air to ground communication. For the future it is intended to install a V.H.F. direction-finding scope, and runway lighting will be provided by the end of the year. To a passenger accustomed to 60-minute coach journeys between airports and city terminals, it came as a pleasant surprise to find that Biarritz Airport is only one and a half miles from the centre of the town.

Inauguration of the B.E.A. service reduces the time of the fastest London-Biarritz journey by about four hours, since it was previously necessary to complete the trip with a four-hour road or rail connection. If he so desires, the traveller can book through to San Sebastian in Spain, which is only a short distance by road from Biarritz. Journey time will be further reduced when traffic builds up to the point where Viscounts or Elizabethans can take over from the Vikings.

Meanwhile, these veteran airliners can still offer reasonably fast (200 m.p.h.) and comfortable service, even in 36-seat tourist form. And judging from our experiences of the inaugural flight, the passenger is assured of good cabin service and pleasant scenery *en route*. He can also be sure of a warm welcome and a memorable holiday in the picturesque Basque country, with Biarritz as its centre. When we prepared to board our Viking for the return journey we found that the proprietor of our hotel, the Château des Falaises, had made his way on to the apron to say goodbye. This incident was typical of the hospitality shown to British visitors during their stay.

Direct services to Biarritz leave Northolt on Mondays and Fridays, returning in the afternoons. Stopping services, which remain at Bordeaux for 30 min, leave and return on Saturdays and Sundays; during July, London-Bordeaux-Biarritz services will also operate on Tuesdays and Thursdays. Fares to Biarritz are £17 10s single and £31 10s return.

NEW AMERICAN TRANSPORTS (continued from page 739)

military Connies building—R7Vs for the Navy and C-121s for the Air Force) may make the decision to build their jet first. Douglas are still cautious as a result of their precarious years in the late '40's when the DC-6 market dried up at about 140 aircraft. They came through well, however, and the first quarter of this year was the most profitable in the company's history. There is usually a little more money to be made out of civil than military orders.

If the Douglas organization is estimated to be worth a nominal $100m what effect might a P.V. jet transport have? They state that in very round figures, a prototype might cost, say, $25m; certification and production tooling $50m; period to production and selling in break-even quantities the other $25m, and so they may have to risk the lot—less perhaps tax adjustments. These estimates seem to be well on the high side, however.

The Douglas company usually reckons to be a little slower and more expensive over its prototype building but a bit cheaper and quicker in production. So far about $3m has been invested in the DC-8 project to reach an advanced stage of readiness for construction. This compares with the Boeing outlay now approaching $17m.* The DC-6B costs, in round figures, $1½m, and the DC-7 $1¾m. The DC-8 jet airliner is costed at something like $4m—a cost-price which perhaps now represents some 15-20 per cent of the aircraft direct operating costs with a large company. According to Douglas, to try to reduce the selling price by paring here and there would be to impair the aircraft's potential earning capacity. The cost of the Boeing 707 may be rather less than that of the DC-8, though in the same region, while the fully equipped Comet 3 may cost just under $1m.

For popular consumption, Douglas estimate that an extra 1lb of structure weight represents 1 lb of gold in lost carrying capacity, and a sq ft of frontal area added is equivalent to 1 cu ft of gold in cost of drag—both for the life of the aircraft.

Regarding timing, it is felt in California that, if production tooling is to await a military order, the Boeing lead over other U.S. companies may not be as great as it seems. A military order would of itself delay civil deliveries and give the other companies a chance to catch up (though Boeings would retain some advantage in selling price, due to military-order aid to civil production).

If Lockheed went ahead tomorrow the prototype might fly in 18-24 months and deliveries might begin in a minimum of two more years; thus tickets might be sold early in 1959. This is the sort of date Boeing have in mind for the new Stratoliner, as they call the civil machine. Comet 3s may be able to cut as much as two years off this date if the troubles can be solved and no major structural changes are called for.

Of the British lead, the U.S.A. feels that the turbojet advance has been reduced and that it is also partly offset in the transport market by America's greater experience and superior engineering practices.

In conclusion, it may be recorded that Lord Hives, of Rolls-Royce, was described to the Editor, by two different people, as "the best aero engine salesman in the world." The development of his by-pass Conway is obviously being watched with interest in America, but we gather it is unlikely to be adopted unless P. and W. run into trouble with the civil J57 (when one is developed)—and trouble seems very improbable. Like very many other British engineering products, the Conway is not built on the North American continent; thus, however good, it starts off with a considerable handicap spareswise and service-wise, to use a convenient but overworked American suffix. This position might of course be remedied in more than one way. Americans say that by-pass engines are inflexible and must be matched to an airframe as the Conway is to the Vickers 1000. But this seems to apply equally to any gas turbine power unit.

**In view of the statements and allegations regarding State assistance in the development of the Comet we may quote figures from American sources: Until the beginning of this year Boeing recovered 82 cents—which would otherwise have gone in taxes—of each dollar spent on the prototype. Since the start of this financial year Boeing and other companies have to pay in "48-cent dollars" rather than "18-cent dollars." Thus, in one sense, Boeing have already received a $12m subsidy, four developed turbojets and B-52 wing data for the Stratotanker, as compared with about £1½m received by de Havilland for the Comet 1.*

CIVIL AVIATION . . .

BREVITIES

ACCORDING to Swedish newspaper reports, S.A.S. may purchase five to seven DC-7s in collaboration with an unnamed United States airline. It is stated that the new aircraft would be used on the Scandinavian airline's North Atlantic route during the summer season and on American domestic routes in winter.

* * *

The following amendments to British civil airworthiness requirements have been published by the Air Registration Board: *Contents, Issue 23; and Section A, Issue 3,* which deals with general information and procedure.

* * *

Westminster Airways Servicing, Ltd., announce the appointment to the Board, as from May 27th, of Major Reginald E. Nicoll. His co-directors include the Hon. Max Aitken (chairman) and A. Cdre. A. V. Harvey (managing director).

* * *

Swissair opened their first South Atlantic service on May 27th, when one of the company's DC-6Bs left Zurich for Sao Paulo *via* Geneva, Lisbon, Dakar, Recife and Rio de Janeiro. To be operated weekly, the new service carries 48 first-class passengers and completes the journey in 30 hours (of which only five hours are spent on the ground at transit stops).

* * *

On May 24th an impressive performance was put up by a DC-7 of United Air Lines which flew, fully loaded, from New York to Honolulu in 17 hr 9 min elapsed time (including 1 hr 12 min on the ground at San Francisco, the only stop). Block speed for the 5,000-mile journey, made against headwinds, was 312 m.p.h.

* * *

Now visiting this country, with a view to recruiting executives, crews and engineers, is Mr. F. M. McGregor, the recently appointed general manager of Pakistan International Airlines. The company has taken delivery of three Super Constellations, which are being introduced to service this month on the Dacca-Karachi route, providing a 3 hr, non-stop link between East and West Pakistan. Next month P.I.A. will open a fast first-class Super Connie service to London, flying from Karachi to London in 15 hr with a single stop in the Middle East.

Aer Lingus, the Irish airline, celebrated its 18th anniversary on May 27th. The company reports that during the peak of the 1954 summer season its aircraft will carry more than four times as many passengers in a day as in the entire first year of operations (the total for 1936-37 was 800).

* * *

On May 21st Air France opened a new direct service from London to Marseilles to serve resorts on the coast between Marseilles and St. Raphael. This service is flown by DC-4s on Fridays, Saturdays and Sundays until July 18th and again from August 31. From July 19th to August 30th there will be an additional flight on Mondays. The service terminates at Nice. The first flight was made by DC-4 F-BELP (Capt. Ray), which flew from L.A.P. to Marseilles in 2 hr 55 min.

Mr. N. J. Wadsworth.

* * *

Delivery of the first of 15 Viscounts ordered by Trans-Canada Air Lines is due to begin in August, and Vickers-Armstrongs have announced that a $100,000 stock of spares is being set up in the Canadian airline's base at Winnipeg. Technical liaison will be provided in Montreal by Mr. Norman J. Wadsworth (left), a senior member of Vickers' technical staff, assisted by two service engineers.

* * *

Mr. Peter Masefield, chief executive of B.E.A., forecasts that his company's aircraft will be responsible for 50 per cent of the total movements at London Airport by the summer of 1955. He adds that although L.A.P. will be able to accommodate all the Corporation's services during 1956-57, B.E.A. will need to overflow to some other airport in 1958, and that "provided there is a favourable outcome to the recent inquiry" the Channel Islands services will then be concentrated at Gatwick.

ULTRA-LIGHT MOMENTS at the Leicestershire Aero Club's display on May 22nd. In these "Flight" photographs are, reading clockwise, the Dart Kitten (flown by A. C. Waterhouse and by O. Maidment), Fairey Junior (C. G. Alington), B.A.C. Drone (A. C. Waterhouse and A. Hughes), and an Olympia sailplane—seen being spot-landed before the public enclosure by Jack Rice.

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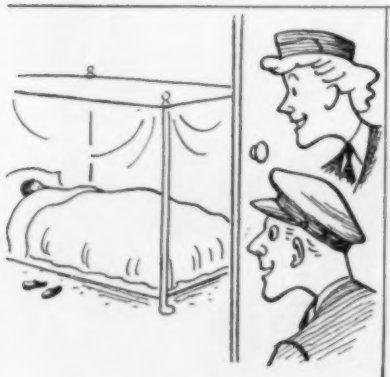

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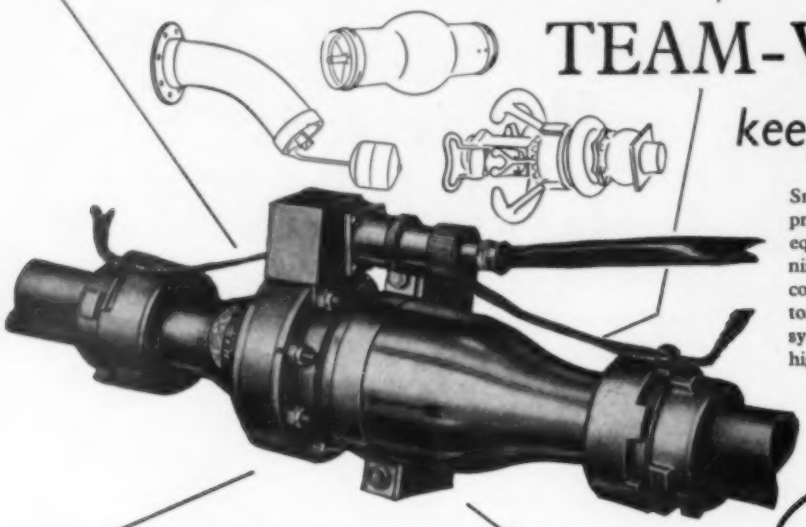

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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

ALL-WEATHER: Many regular fighter squadrons of the Royal Air Force are exchanging Armstrong Whitworth Meteor NF.11s for more-effective Mk 12s. This pleasant day-time study shows a flight of No. 25 Squadron, now completely Mk 12-equipped. Points of note are the fully-streamlined nose (in the Mk 11, the scanner motor required a separate bottom fairing) and the area added to the fin leading-edge. Later this month, the C.A.S. will present the squadron's Standard.

Promotion for the C.A.S.

THE *London Gazette* for June 1st announced the promotion of Air Chief Marshal Sir William F. Dickson, G.C.B., K.B.E., D.S.O., A.F.C., Chief of the Air Staff, to the rank of Marshal of the Royal Air Force.

Sir William comes of a family with strong Naval ties—on his mother's side he is related to Lord Nelson—and joined the Royal Naval Air Service in October 1916. He was connected with many of the early ship landing trials, including experimental deck landings on H.M.S. *Eagle* in 1920. He has been a test pilot at Farnborough and at one time commanded No. 25 Squadron.

At the outbreak of war in 1939, he was serving in the Directorate of Plans. He became Director of Plans in 1941, and in the following year was appointed A.O.C. No. 9 Group, Fighter Command. Towards the end of 1942, he went to No. 10 Group, Fighter Command, also as A.O.C., and afterwards commanded No. 83 Group, 2nd T.A.F., until early in 1944, when he was given command of the Desert Air Force in Italy. At the end of 1944 he was appointed Assistant Chief of Air Staff (Policy) at the Air Ministry and in June 1946, he became Vice-Chief of the Air Staff, a post which he held until he went to the Middle East as Commander-in-Chief. Before becoming C.A.S. Sir William was Air Member for Supply and Organization.

Queen's Birthday Fly-past

A CEREMONIAL fly-past over Buckingham Palace by 27 fighters of the Royal Auxiliary Air Force will take place on June 10th, the Queen's birthday. The aircraft are due to pass over the Palace at 1 p.m., when Her Majesty will be on the balcony to receive the salute. Should there be a postponement of the Trooping the Colour, due to take place in the morning, the fly-past will be 5 p.m.

Leading will be nine Vampires of No. 603 (City of Edinburgh) Squadron, of which the Queen is Honorary Air Commodore; second will be nine Meteors of No. 500 (County of Kent) Squadron; third are nine Vampires of No. 501 (County of Gloucester) Squadron.

This is the first time the Royal Auxiliary Air Force has undertaken a ceremonial fly-past in honour of the Sovereign's official birthday.

Hail and Farewell

A REUNION which must have been unique took place on May 27th at R.A.F. Andover, when all the five men who had shared one hut at Cranwell in 1923 attended a dinner to mark the retirement of one of their number. The hut was No. 17 and the course that of February 1923; those concerned were—in their present ranks—G/C. R. J. A. Ford, C.B.E., who is retiring, A.V-M. the Earl of Bandon, C.V.O., C.B., D.S.O., A.V-M. G. R. Beamish, C.B., C.B.E., A.V-M. N. S. Allinson, C.B., and W/C A. H. W. J. Cocks, B.A.

Also present at the dinner were a large number of officers from the R.A.F. Staff College at Andover, including many from foreign air forces, and members of the H.Q. No. 41 Group, as well as Capt. L. F. Bennett, R.N., Commanding officer of H.M.S. *Ariel*; Brig. G. J. de W. Mullins, O.B.E., Assistant Commandant of the School of Land-Air Warfare; A.V-M. B. E. Essex, C.B., C.B.E., the S.A.S.O. at Maintenance Command; and A.Cdre. D. W. Lane, C.B.E., Commandant, R.A.F. Staff College, Andover.

President for the evening was A.Cdre. W. F. Langdon, C.B.E., the S.A.S.O. at No. 41 Group, and after the loyal toast and that to "Foreign heads of state here represented," A.V-M. G. Combe, C.B., A.O.C. No. 41 Group, made a speech of valediction to G/C. Ford. He recalled the earliest days of the quintet at Cranwell, tracing the progress of G/C. Ford's very varied interests and occupations, from early episodes in Snipes at Hawkinge (where he earned the nickname of "Revver"), through inter-war Middle East and Transport Command postings and wartime years in the Middle East to his penultimate post as commander of R.A.F. Uxbridge and all that this implied.

G/C. Ford, replying, recalled in his turn many events of the past. Finally, much later in the evening, he was formally and literally "bowler hatted."

IRISH AUXILIARIES: The Queen's Standard of No. 502 (Ulster) Squadron, R.Aux.A.F., being marched past the saluting base during the recent presentation ceremony at Aldergrove. On the dais are: Viscount Brookeborough, Prime Minister of N. Ireland and Honorary Air Commodore of the squadron; Lord Wakehurst, the Governor, who made the presentation; and Air Marshal Sir Dermot A. Boyle, A.O.C-in-C. Fighter Command. In the Standard party are: F/O. I. A. Leinster, F/S. A. Gibson, F/S. W. A. Burns and F/S. P. Scott.

"Tropic Strike"

OPERATION Tropic Strike, held in Australia last month, exercised the Royal Australian Air Force in its ability to mobilize regular and auxiliary units in the south and quickly transport them for service in the north.

In the exercise over 300 men drawn from the Citizens Air Force Squadrons of Melbourne and Adelaide, and No. 6 Squadron at Amberley were flown to Darwin by transport aircraft of No. 86 Transport Wing.

The Lincolns flew on navigation and radar bombing flights of eight to ten hours' duration, dropping live bombs on the R.A.A.F. range near Darwin.

Speaking after the exercise, the Minister for Air, Mr. McMahon, said: "The operation has proved the soundness of the policy for the defence of the north." This policy is for large, highly trained estab-

SERVICE AVIATION . . .

lishments in the south, where maintenance costs are much lower than if they were maintained wholly in the north.

Two R.A.F. Appointments

UPON leaving his post as S.A.S.O., H.Q., Transport Command, A. Cdre. H. F. G. Southey, C.B., is to become A.O.C., R.A.F. Element, Maritime headquarters, Chatham.

A. Cdre. Southey was station commander at R.A.F. Lyneham before he joined Transport Command in 1952, and before that (in 1950-51) was in the London Echelon of the C-in-C. Western Europe. At the beginning of his Service career, in 1925, he passed through Cranwell, then to Calshot for seaplane training; thereafter he specialized in armament, signals and staff duties. He was mentioned in despatches in 1944.

A. Cdre. M. E. M. Perkins, B.A., A.F.R.Ae.S., who, since July 1952, has been on an exchange posting in the U.S.A., has been appointed S.T.S.O., Fighter Command. He was commissioned in 1929 and was on flying duties with No. 13 Army Co-operation Sqn. until 1934. He thereafter took up engineering and staff duties in India and with Bomber Command H.Q. He served in the Ministry of Aircraft Production during the war and, before going to America, was Deputy Director of Technical Plans in the Directorate of General Technical Services.

Church Parade

ON May 23rd, No. 600 (City of London) Squadron, R.Aux.A.F. held their annual church parade in the church of St. Bartholomew the Great at Smithfield. The scene above (photographed by special permission of the rector, Dr. N. E. Wallbank) shows the squadron standard being marched from the Altar at the conclusion of the service. In the Lady Chapel beyond the Altar is the memorial to members of No. 600 Squadron who died in the war. It was unveiled by Queen Elizabeth the Queen Mother, who is the Honorary Air Commodore of the unit. St. Bartholomew's is the church of the priory founded by Rahere at Smithfield in A.D. 1123. The Lady Chapel was completed in A.D. 1336 and has passed through many vicissitudes; at one time it was a dwelling-house, and at another it was part of a printing establishment. Repairs to the church structure are now urgently due, and it is felt that many friends and past members of No. 600 Squadron, and relatives of men who fell while serving with the unit, may like to subscribe. Donations should be sent to The Rector, St. Bartholomew the Great, Smithfield, London, E.C.1.

No. 600 SQN. at service in the church of St. Bartholomew the Great (see "Church Parade" below).

R.A.A.F. IN ANTARCTICA

PERSONNEL of the R.A.A.F. attached to the Australian National Antarctic Research Expedition (an article on which appeared in *Flight* of March 26th last) returned recently to Melbourne aboard the expedition's motor vessel *Kista Dan*. Though they lost one of their Auster aircraft from the ship in a 100 m.p.h. hurricane and had the other one damaged, they completed 80 hours' flying, during which time 300 miles of Antarctic coastline was systematically photo-mapped. The pilots were F/L. Douglas Leckie and Sgt. Raymond Seavers.

The expedition's base, Mawson, 4,000 miles south-west of Melbourne, has been named after Sir Douglas Mawson, the Australian Antarctic explorer. Ten men were left by the ship to do a year's research work at this, Australia's first permanent base on the Antarctic continent. They are 1,500 miles from the South Pole, and will be in darkness for three and a half months of their year. Auroral conditions may make direct radio communication with the Australian mainland difficult, and messages will be routed through Heard Island, 1,000 miles to the north, where a weather station was established by an expedition in 1947.

Mounted on skis for part of the operations, the Austers set their pilots some new ground-handling problems. On more than one occasion, F/L. Leckie found that, as soon as he switched off after landing on ice, the aircraft began to blow backwards. He had to keep on just enough power to counteract the wind force; the ground-crew could then seize the aircraft and secure it.

Another problem arose from the fact that, when a ski aircraft is taxying on snow, the friction of the skis melts the surface; then, when the machine comes to rest, the melted snow freezes almost instantaneously and binds the skis to the surface. The R.A.A.F. crews found that only by rocking the aircraft and getting them on the move immediately could the glue-like grip be broken.

Engine starting was facilitated by the use of an "elephant's trunk"—a large-diameter flexible tube to carry warmth from an oil stove to the engine.

One of the Austers was equipped with floats, but off-water operations were frequently hampered by unsuitable sea conditions; seldom was there the ideal rippled surface which assists a seaplane to "get on to the step" and unstick. Another difficulty arose through the formation of ice on the floats while taxying.

Nevertheless, the floatplane proved very useful. Whenever *Kista Dan's* way ahead appeared to be blocked by ice, the Auster was lowered into the water and, the pilot having selected a sufficiently clear take-off path, flew ahead to find a channel through the pack. When the coast was reached, the ski-equipped aircraft was brought into use, first to examine the base site and later for survey work.

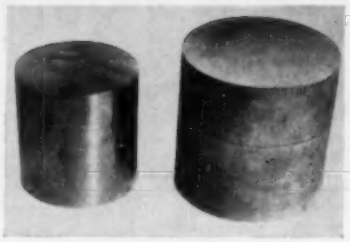
F/L. Leckie experienced an engine failure through water getting into a pipeline and freezing. "I had to land cross-wind on heavy ice-pack in a strong southerly," he told a correspondent on his return to Melbourne. "The aircraft did a ground-loop and ran along backwards on its skis. Fortunately we were near the ship." Sgt. Seavers also had a forced landing at Mawson.

The ground-crew, who are described as having "done a magnificent job," were Sgt. K. W. Duffel (fitter) and Sgt. F. W. Morgan (rigger).

One of the two R.A.A.F. Austers used by the Australian National Antarctic Research Expedition: this aircraft, float-equipped, was used to find sea lanes through the pack ice.

WHERE WEIGHT IS WANTED

Recent Developments in G.E.C. Heavy Alloy: Aircraft Applications



A compact before (right) and after sintering, showing the volume reduction which takes place.

INCREASING demand for G.E.C. Heavy Alloy has recently dictated the transfer of its manufacture from a laboratory pilot plant to full-scale production in the Osram-G.E.C. metals factory at Wembley. Improved tungsten supplies have made it possible to lift restrictions on the use of Heavy Alloy (of which tungsten is the major constituent), and a new series of alloys are now being developed with densities exceeding 18 g/c.c. and thus approaching the theoretical density of tungsten. These new alloys are fully machinable and show mechanical properties comparable with those of the existing Heavy Alloy. G.E.C. are also developing a high-density alloy characterized by higher elongation without corresponding decrease in tensile strength; it will be available in the form of sheet of limited dimensions.

Briefly, the production of G.E.C. Heavy Alloy calls initially for the use of tungsten, nickel and other constituent powders to stringent specifications for chemical and physical properties. These powders are mechanically mixed, placed in a die and compressed. Heating of the compact at a carefully controlled low temperature then brings it to what is known as the "green" state, in which it can be given further shaping to the final contours required. It is finally placed in an electric furnace in a hydrogen atmosphere and sintered at white heat, approximately 1,450 deg C.

During this process the compact shrinks by nearly 20 per cent in volume, with a corresponding increase in density of from 10-12 g/c.c. to the final density required. Since this decrease in volume is closely calculable the original dies can be designed with precision for many shapes or sizes of sintered product.

(Left) The flywheel of the Dunlop Maxaret brake, machined from G.E.C. Heavy Alloy. (Above) Sperry electric gyro-horizon assembly, with squirrel-cage rotor Araldite-bonded to interior of Heavy Alloy cup.

G.E.C. Heavy Alloy is resistant to atmospheric corrosion, but it can be given any of the usual plated finishes if required. Average properties of material having a density of from 16.5 to 17 are quoted as follows (tested in accordance with BA.19 : 1950):—

Specific gravity*	16.5 to 17
Approximate weight	0.6 lb/cu in
Tensile strength	42 tons/sq in
Yield point	38 tons/sq in
Brinell hardness number	290
Coefficient of expansion at 20-420 deg C ...	5.6×10^{-6}

*The specific gravity of lead is 11.4.

G.E.C. Heavy Alloy is finding increased applications in many fields, notably that of radiology. In aircraft construction, of course, it has been known for many years, its principal use being for the mass-balancing of control surfaces. In most situations the compactness of the material makes it possible for the mass to be completely contained within the structure; but where it has to be an exterior fitting it offers the minimum amount of frontal resistance in comparison with other materials.

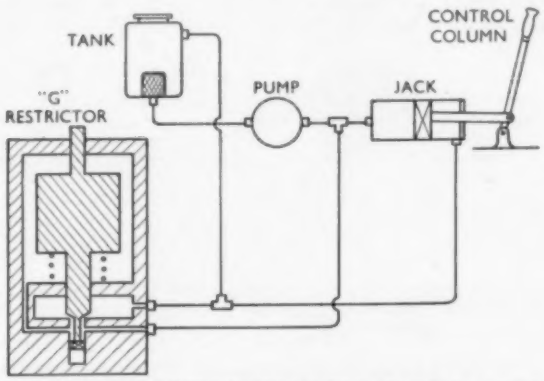
This application, and that for dynamic balancing in aero engines, is a familiar one. Latterly, however, it has found a number of new uses in specialized aeronautical equipment. For instance, what might be termed the "heart" of the Dunlop Maxaret braking system is the flywheel which monitors the pressure supply. In many undercarriages, particularly of the bogie type, the space available for the flywheel is severely limited, so it is not surprising that Dunlop Aviation Division use the G.E.C. material. They obtain it in the form of a blank made to close limits, machine it all over, grind a ball race in it and machine away the thin central web to leave a single diametral spoke. The alloy is amenable to all these operations and is machined to a tolerance of 0.003in. It is sufficiently hard to form a race for 3/32in dia. steel balls on each side of the central web. Rotational speeds may reach 8,000 r.p.m.

Instrumentation is another sphere in which the G.E.C. material finds a use. The rotating assembly of the Sperry electric gyro-horizon, for example, is a squirrel-cage rotor which, on a vertical axis, spins around the stator windings; and the cage is housed in a cup of Heavy Alloy, to which it is bonded with Araldite. The weight is thus concentrated as near the periphery as possible, providing maximum inertia. The rotor must undergo a speed test at 30,000 r.p.m., so high tensile-strength is essential.

The material finds a similar use—as a tyre on a rotor—in Smith's air-driven artificial horizons and gyro direction-indicators. Normal operating speeds of the rotors are 15,000 r.p.m. and 18,000 r.p.m. respectively. Dynamic balancing is carried out on the rotors by drilling out portions of the Heavy Alloy as required; balance of the order of 1 mg/cm is obtained in this way.

The alloy finds another application in a g-restrictor developed by British Messier, Ltd. It is used for the 2 lb weight which, acting against a spring, closes a hydraulic valve and operates a jack that produces a control-force in opposition to that exerted by the pilot. As the size of the chamber containing the weight is a critical factor in the design it was important to employ as dense a material as possible; and lead would have been subject to electrolytic action with the hydraulic fluid.

Vinten cameras are well known in aeronautical test and research work, and the H.S.300 high-speed model can operate at no less than 275 frames a second. In these circumstances, perfect balance of the motion is essential for a steady picture; G.E.C. Heavy Alloy, as the only material to give sufficient weight in the available space, is employed for the crankshaft counterweights.



Hydraulic circuit of the British Messier g-restrictor for reducing excessive vertical accelerations by automatically loading the control column in the opposite sense. A critical vertical acceleration causes the 2 lb Heavy Alloy weight (at left) to compress the spring on which it rests and thus close a valve to divert hydraulic pressure to the loading jack.

AEROMAGNETIC SURVEY OF BRITAIN

IN a statement in the House of Commons on May 25th Mr. Bevins, Parliamentary Secretary, Ministry of Works, said it was hoped to make an aeromagnetic survey of the British Isles. At present the survey was only in the project stage and Government financial support was still awaited; about £½m would be required.

A preliminary survey is to be made during the next year or 18 months in order to discover the degree of sensitivity and accuracy which would be required in the readings obtained. No decision has yet been made as to which of the available instruments or techniques is to be used. The project is under control of the Department of Scientific and Industrial Research.

THE INDUSTRY

Rolls-Royce Apprentice Schemes

YOUNG men contemplating a career in the aero-engine industry will find a great deal of helpful information in two brochures lately published in new editions by Rolls-Royce, Ltd., Derby. One of the two gives details of the six forms of apprenticeship which the company is in a position to offer—trade, technical, engineering, laboratory and commercial; the other is devoted entirely to the graduate-apprenticeship scheme. Both publications are very fully illustrated with photographs of Rolls-Royce apprentices at work and at play.

Intending applicants (who should address their inquiries to the training manager) may wish to know something about the locations of the company's various factories, and for their benefit the brochures contain the following note:—

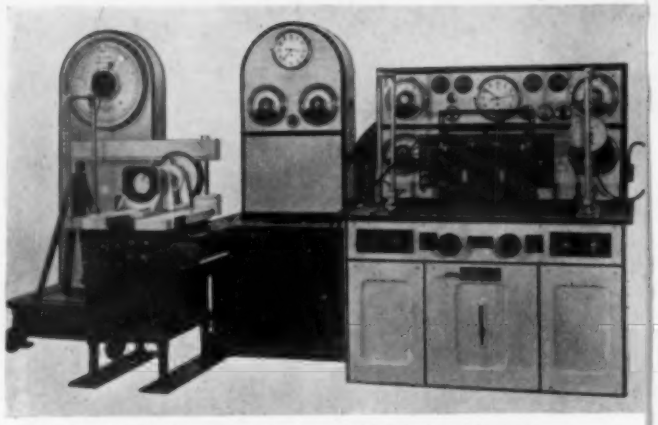
"The Aero Division has its headquarters at the parent factory in Derby, and here is carried on most of the design and development work. There are also factories at Mountsorrel, near Leicester, Barnoldswick in Yorkshire, and a flight development department and airfield at Hucknall. In 1938 the first of the Glasgow group of factories was opened at Hillington and post-war expansion led to new factories at East Kilbride, Larkhall and Blantyre. Cars are now made at Crewe, while oil engines are manufactured at a newly built and growing factory at Derby."

For Starter-Motor Testing

RECENTLY introduced by the City Electrical Co., Ltd., Emerald Street, London, W.C.1, as an addition to a range of equipment for load and torque tests on electric motors, generators, pumps and compressors, is the S210 torque tester. It has been specifically designed to determine torque output of aircraft starter motors used on either piston-engines or gas turbines.

For piston-engine starters, which run at comparatively low speeds, the equipment utilizes a pony brake of accepted standard, giving readings on a large scale-dial; for high-speed turbine starters, a step-down gearbox is inserted between the motor and the brake. A rectifier is included to provide direct current, together with a unit for 24-volt supplies, a carbon pile providing voltage regulation. Similar units are available with series/parallel switching to provide 24 to 112 volts output. The main direct-current ammeter and voltmeter, and a clock, are mounted above the rectifier, in a position clearly visible to the operator.

Another feature of the apparatus is a bench for tests of high-speed motors and turbine starter-motor panels. Its instrument panel carries a main ammeter and voltmeter, clock, coil-current ammeter and H.T. alternating current flash-test panel. For tests of starter panels the main contractors are loaded to 500 amp D.C., obtained from the main rectifier and absorbed by the carbon-pile resistors. The supply to the operating coils of the contactor and timing relays is obtained from a small battery which is contained within the bench and has its own charging rectifier and instruments. For some starter circuits, lamps at the top of the instrument panel act as resistances. A tubular gantry on each side of the bench is provided to carry spring balances when high-speed motors are being tested.



The City Electical motor-test equipment described on this page.

To Secure Cable-runs

FROM Howard Clayton-Wright, Ltd., Wellesbourne, Warwickshire, comes a leaflet describing their new Claytonrite moulded "Nylastic" support clips for cable and piping runs. Available in six sizes, these clips are strong, light in weight (the specific gravity of nylon, of which they are made, is 1.14) and are resistant to the various liquids with which, in aircraft use, they are likely to come into contact. Although there is a certain amount of flexibility inherent in the plain clip, a sponge-rubber-lined type is also available, as in an earthing clip with a copper lining tongue.

In all these clips, fixing is provided for by a hole at one end and a slot at the other, internal serrations being provided to fix the clip diameter positively when the securing bolt is tightened.

IN BRIEF

Boulton Paul Aircraft net profit for the year ended July 31st, 1953, recently announced, was £226,483 (previous year, £107,744). At a meeting of the Board, it was decided to recommend a dividend of 15 per cent, less income tax at 9s.

* * *

Recent appointments by Shell-Mex and B.P., Ltd., include that of Mr. R. G. Woodman as aviation manager, southern division.

* * *

A most useful pocket-size publication by High Duty Alloys, Ltd., Slough, Bucks, is *Hiduminium Aluminium Alloys and their Foreign Equivalents.*

* * *

Care and maintenance of K.L.G. aviation plugs (Corundite insulator types) is the subject of a new illustrated brochure—publication No. K.A/1—issued by Smiths Aircraft Instruments, Ltd., who are sole distributors of K.L.G. aviation plugs.

* * *

Murex Welding Processes, Ltd., Waltham Cross, Herts, have issued matter dealing with their zirconiated tungsten electrodes for use in argon-arc welding. It is stated that these new electrodes have greater resistance to the pure tungsten and thoriated tungsten generally used in this process.

* * *

Mr. H. Cock, A.C.A., has been appointed secretary to Lodge Plugs, Ltd., Rugby. Leaving Cadbury's in 1948 to join Lodge as accountant, he was promoted to assistant secretary last year. In his new post he succeeds Mr. G. Harrison, who has been with the company for 30 years.

* * *

Designed to perform the important function of removing corrosive moisture, abrasive scale and other unwanted matter from compressed-air lines, transparent-bowl filters are described in a leaflet from C. A. Norgren, Ltd., Shipston-on-Stour, Warwickshire. Four models are available, for pipe sizes from ¼ in to 1 in.

The British Aluminium Co., Ltd., announces that Mr. George Boex will be retiring from his joint managing directorship on July 4th; he will be succeeded by Mr. W. J. Thomas. Mr. Boex will remain a director and has agreed to carry out any consultant work which the Board may ask him to undertake.

* * *

As a result of a recent visit to the U.S.A., Mr. Clifford Shaw, a director of Shaw Processes, Ltd., was able to open negotiations for 15 U.S. firms to take out licences for the company's foundry processes. In Canada, Mr. Winnett Boyd, formerly chief designer to A. V. Roe (Canada), Ltd., was formerly appointed to represent Shaw Processes, Ltd.

* * *

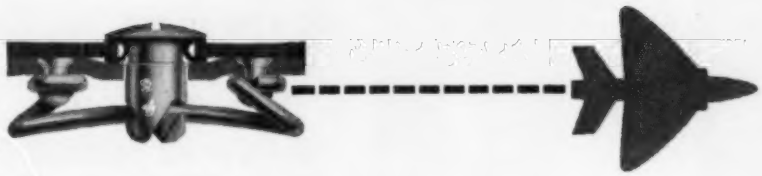
Among the instructional wall charts which are a speciality of the Illustrated Classroom Education Co., Ltd., of 30/31 Hanover Court, Hanover Square, London, W.1, is a 40in x 30in chart explaining the operation of a turbojet. This particular chart is obtainable, price 5s 6d, direct from G. B. Film Division, 1, Aintree Road, Perivale, Middlesex.

* * *

Representatives from the Imperial Defence College, during a recent tour of northern industrial centres, saw an interesting demonstration of two aircraft tractors at the Meltham, Yorkshire, factory of David Brown Tractors (Engineering), Ltd. The lighter machine, weighing just over two tons, was used to tow the heavier—nearly five tons—up a half-mile gradient of 1 in 6.

* * *

Trading results of James Booth and Co., Ltd., for 1953, announced at the recent annual general meeting, showed a surplus of £199,699 after transferring £50,000 from stock reserve to meet losses arising from falls in metal prices. This, added to the opening balance, left £509,141 available for allocation. A 20 per cent dividend on the Ordinary shares was recommended, amounting to £82,500; £6,160 had been paid on the Preference shares.



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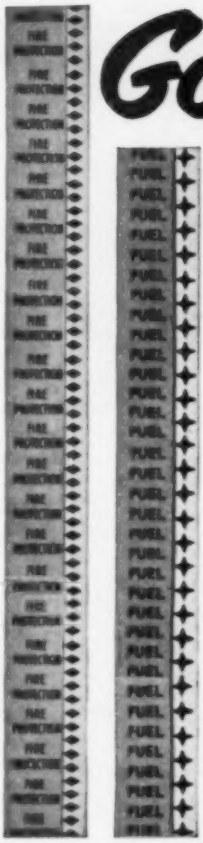

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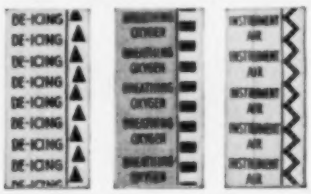

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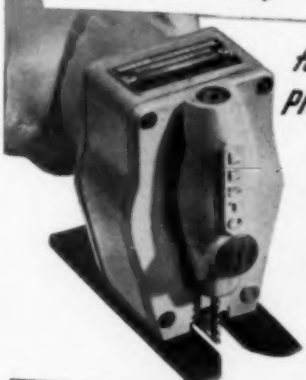

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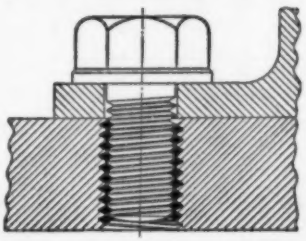

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BRITAIN'S AIR UNIVERSITY CAN TRAIN YOU for an airline career. Hundreds of today's airline captains and key maintenance personnel are graduates of this famous establishment. Courses are available for Commercial and Airline Transport Pilots' Licences, Instrument rating and Maintenance Engineers' Licences. FOR details of these and other courses, apply to—The Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

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FAIRCHILD cameras K24, K20, K19, K8A-B, brand new.—E.W.S. Co., 69 Church Road, Moseley, Birmingham. [1752

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WANTED FOR

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BANGALORE, MYSORE STATE, SOUTH INDIA

(a) **Manufacturing Superintendent**
(b) **Chief Equipment, Jig and Tool Planner and Designer**

APPLICANTS for each of these two positions must
(a) have held equivalent posts for at least 10 years in large concerns in U.K. or other Western countries.
(b) be thoroughly conversant with modern estimating, planning and production methods and manufacturing equipment employed in aircraft and/or aero engine manufacture.

APPLICATIONS should give full details of nationality, age, whether married or single, chronological history of education, former posts and present post held, giving approximately the number of employees of employer firms and number of persons for whom applicant was personally responsible, and details of salaries received. Applicants should state engineering degrees obtained and/or membership of recognised engineering institutions.

PROPOSED consolidated salaries, inclusive of all allowances, are:—
(a) Manufacturing Superintendent £2,250-£2,500.
(b) Chief Equipment, Jig and Tool Planner and Designer £2,000-£2,250.

SALARY level may be adjusted according to ability and experience of successful applicants.

EARNINGS and allowances will be paid in rupees and be subject to Indian income tax.

THE appointments will be for a three-year period.

FREE Single 1st-class return passage by sea, or air passage, for self and wife will be provided by the company.

LOCAL leave (1/11th of the period spent on duty).

SICK leave (15 days per year) and Casual leave (12 days per year) will be included in terms of contract. Also Home leave of 3 months for the entire contract period will be allowed at the end of, but not during, the contract period.

REFERENCES from reputable persons engaged in the industry will be required. Applications will be treated as confidential.

FORMS of application may be obtained, on application by postcard, quoting No. 6/4 E, from the High Commission of India, General Department, Aldwych, London, W.C.2. Last date for receipt of applications June 30th, 1954. [2119

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

FLYING instructors. Only fully qualified and experienced men need apply.—Blackpool and Fylde Aero Club, Blackpool. [2102

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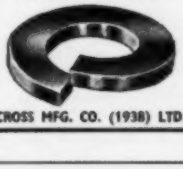

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ENGINEERS

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APPLICATIONS from men with experience in any of the following will be particularly welcome:—

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Forward Project Design
Blade Design
Control Systems
Full-scale Engine Design
Engine Test Administration
Performance Analysis and Report Writing
Vibration Investigation
Failure Investigation
Engine Build Specification Research
Jig and Tool Design
(only senior positions)
Planning
New Process Development
(particularly sheet metal fabrication)
Test Plant Design

Applications should be addressed to:—
CENTRAL PERSONNEL SERVICES,
336-7 Strand, W.C.2.
Quoting reference S.A.30H
Saturday morning interviews can be arranged in London or, in special cases, near the applicants' homes. [2056

PHYSICISTS AND ENGINEERS

ELLIOTT BROTHERS (LONDON) Limited, Guided Weapons Division, requires Physicists and Engineers for research and development work in the North London area. Applicants should possess Higher National Certificate or a degree in Physics or Electrical Engineering. Experience in research, development and design in one or more of the following subjects is desirable but not essential.

(a) **Microwave aerials, waveguide components and instruments.**
(b) **Radar circuit techniques.**
(c) **Electro-mechanical instruments.**
(d) **Electric and Hydraulic Servo-mechanisms.**

SALARY will be according to qualifications and experience and senior positions are available. Applications, giving details of age, education and experience, should be made to Personnel Officer, Elliott Brothers (London) Ltd., Elstree Way, Borehamwood, Herts., quoting Ref. 5206. [2073

GRADUATE OR CHARTERED ELECTRICAL AND MECHANICAL ENGINEERS

required by

THE ENGLISH ELECTRIC CO., LTD., LUTON

for work on

GUIDED WEAPONS

in Project Co-ordination Department.

EXPERIENCED development engineers and technical assistants wishing to broaden and gain experience in this type of work are invited to apply. Experience in aircraft industry an advantage, but not essential.

POSITIONS are permanent and progressive, carry attractive salaries for right men, with staff pension after qualifying period. Reply to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. S.A.26H. [2127

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Brough, E. Yorks.

ENGINE DIVISION

THE following vacancies exist on design and development projects on piston and gas turbine engines.

(1) **Engine Designers**
(2) **Technical Assistants** (Min. quals. H.N.C.)
(3) **Weight Engineers**
(4) **Technical Authors**

THESE are staff positions with pension scheme and insurance benefits. Apply in writing to Personnel Manager at above address. [2116

FLIGHT INSTRUCTOR for newly-formed American Flying Club. 25 members to solo; will hire by month or by the hour.—Lt. C. O. Petersen. Tel.: West Drayton 3341 Ex. 138, or Iver 403. [2132

THE DUNLOP RUBBER CO. LTD., AVIATION DIVISION, COVENTRY

requires

SENIOR DESIGN DRAUGHTSMEN

capable of carrying projects through from conception to completion.

Also

JUNIOR DETAIL DRAUGHTSMEN

and

SENIOR AND JUNIOR STRESSMEN

Experience of light hydraulic and pneumatic equipment would be advantageous.

The company's programme offers excellent prospects of permanent interesting employment under congenial working conditions.

Salary will be commensurate with qualifications and experience, full details of which should be sent to:—

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with Higher National Certificate or Degree for interesting work on aircraft undercarriages and hydraulics.

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Write in tabulated form to Personnel Manager.

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AN interesting vacancy has arisen for a senior engineer to take charge of and build up a development section in this field with The English Electric Co., Ltd., Luton. Essential requirements are experience in the design and engineering of precision mechanical equipment. Engineers interested are invited to write to Ref. 1326, Dept. C.P.S., 336-7 Strand, W.C.2, for an appointment either in their locality or in London, whichever is preferred. [2131

WIRELESS operator mechanics required for the FALKLAND ISLANDS DEPENDENCIES SURVEY for service in the Antarctic for tour of 18 or 30 months in the first instance. Salary in scale £330 rising to £420 a year plus free quarters, subsistence, clothing and liberal canteen stores while in Dependencies; it is possible to save almost all emoluments. Liberal leave on full salary. Candidates must be able to transmit and receive Morse at 20 words a minute (plain language or code) and be capable of elementary maintenance of wireless transmitting and receiving equipment. WRITE to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30572/FE. [2111

WIRELESS station superintendent required by the NIGERIA GOVERNMENT Posts and Telegraphs Department for one tour of 18 to 24 months in the first instance. Option of appointment (a) on temporary terms with salary, etc., in scale £864 rising to £1,392 a year and gratuity of up to £150 a year, or (b) with prospect of pensionable employment with salary, etc., in scale £750 rising to £1,175 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant of up to £150 annually for their maintenance in U.K. Liberal leave on full salary. Candidates must have had wide practical experience of modern radio techniques and equipment, in particular V.H.F. equipment, and preferably also V.H.F. multi-channel equipment. Write to the Crown Agents, 4, Millbank, London S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30086/FE. [2112

BRITISH OVERSEAS AIRWAYS CORPORATION have two vacancies for engineering instructors in the Central Training Unit, Meadowbank, near London Airport.

DUTIES:—

INSTRUCTION of pilots, flight engineers and engineering personnel on current aircraft or engines, and in basic theory to the standard required of these personnel; writing training manuals and lecture notes.

CANDIDATES are required to possess technical knowledge to standard necessary for M licence in Cat. A or C. Five years' experience in maintenance and overhaul of one of the following:—

AIRFRAMES and/or engines,
or:
AN apprenticeship in aero engineering, with two years' maintenance experience as above;
or:
TWO years' experience as a pilot or flight engineer on multi-engined aircraft with three years' maintenance experience as above.

MARKED ability at expressing aeronautical engineering subjects verbally and in writing. Salary £570 to £785 per annum.

APPLICATIONS should be addressed to Staff Superintendent (Recruitment), British Overseas Airways Corporation, London Airport, Hounslow, Middx. [2115

AIRFRAME and aero engine maintenance fitters required in flight department. Applications, giving full particulars of experience to Chief Clerk, The College of Aeronautics, Cranfield, Bletchley, Bucks. [2110

SKYWAYS, Ltd., require engineer with A or A and B licence for appointment in Middle East. Write particulars and state qualifications to Personnel Manager, 7 Berkeley Street, London W.1. [2103

SENIOR draughtsmen with hydraulic experience required urgently.—Write, giving full information, to Personnel Manager, The de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch, Hants. [2069

CHIEF designer required for London drawing office. Aircraft structure experience essential. High salary rate. Excellent opportunity for experienced man. Write full details in confidence to Box 5695. [2117

BRITISH INTERNATIONAL AIRLINES LTD., Kuwait, invite applications from single men holding a radio engineer's licence, categories A and B or those prepared to accept separation from their families.

PREFERENCE will be given to applicants with Dakota aircraft radio installation experience.

EMOLUMENTS, free of local taxation, and conditions of service include:—

(1) Basic salary in the scale £715 x £25 to £815.
(2) Overseas allowance: single men £200 p.a., married men £250 p.a.
(3) Cost of living allowance of Rupees 706 per month.
(4) Recreational transport and fully furnished quarters at nominal charges.
(5) Free medical service, and home leave at the rate of eight weeks for each year's service in Kuwait.
(6) Three year contract, subject to normal termination clauses.

APPLICATIONS should be addressed to the Staff Manager, Subsidiaries, British Overseas Airways Corporation, Airways House, Great West Rd., Brentford, Middlesex. [2121

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SENIOR PROJECT DESIGNER

with experience in Aero Gas Turbines and Piston Engine Fields. High salary offered for the right experience. Please reply giving details of previous experience to **Dept. C.P.S., 336/7 Strand, W.C.2.** quoting Ref. 1315.

BRISTOL AEROPLANE COMPANY LIMITED

A vacancy exists for a
SENIOR WEIGHTS ENGINEER
in the Aircraft Design Department for work on new projects.

A degree or Higher National Certificate in engineering is required together with some experience of aircraft weight estimation and/or general aircraft design, with a critical design outlook.

Ability to control staff on a small section is also necessary.

This vacancy offers an exceptional design opportunity with excellent future prospects. Good conditions, pension scheme and welfare facilities. Applications giving details of age, qualifications and experience, and quoting D.O.20, should be sent to the **Personnel Manager, The Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.**

AIRCRAFT STRESSMEN AND TECHNICIANS REQUIRED

For a wide range of interesting High Priority Experimental and Development Work

EXCELLENT POSTS FOR KEEN MEN WITH B.Sc. or A.F.R.Ae.S.

or equivalent qualifications

Please write stating age, experience and salary required to:-

THE CHIEF TECHNICIAN

M. L. AVIATION CO., LTD.

White Waltham, nr. Maidenhead, Berks.

SITUATIONS VACANT

JIG and tool draughtsman (senior) required. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Hunting Percival Aircraft Ltd., Luton Airport, Beds, stating age, experience and salary required. [0593

SENIOR and intermediate design draughtsmen, with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work.—Apply, by letter, to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [0612

CHRISTCHURCH. Urgently required by The de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch, Hants, senior aircraft draughtsmen with air conditioning experience preferred.—Write, giving full particulars, to Personnel Manager. [2070

TECHNICAL executive to administrate and operate the technical policy of the Guided Weapons Division of a leading British Company in its field, engaged in the design and development of specialised ancillary equipment for guided weapon projects.

A GOOD degree, with honours, or at least relative professional qualifications backed by some specific theoretical and practical experience of electrical and hydraulic systems; servo mechanisms; gyroscopes; and general instrumentation are imperative; whilst some aerodynamical knowledge and/or experience, though not essential, would be a useful asset.

THE post demands drive, enthusiasm, initiative and administrative ability where a proven record of past achievement will justify a starting salary of upwards of £2,000 p.a. Age range 35-50. Staff pension scheme and housing assistance.

SEND full record and salary required to Box 5731. [2129

CHARGE hand or foreman aircraft fitter to take charge prototype work, leading to production, eventually works manager. New organisation London area. Excellent opportunity. Reply full particulars, experience, salary required. Box 5712. [2120

SENIOR technical assistant required for wide variety of design problems on aircraft and guided missiles. Pleasant working conditions. Superannuation scheme after qualifying period.—Apply, Chief Designer, The Heston Aircraft Co., Ltd., Heston Airport, Hounslow, Middx. Tel.: Hayes 3844. [2006

SEVERAL senior draughtsmen with experience of turbine engine installations required immediately for both fixed and rotating wing installations Good welfare facilities including staff pension scheme.—Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Ltd., The Airport, Luton, Beds, stating age, experience and salary required. [2048

THE ENGLISH ELECTRIC CO., Ltd., have vacancies for aircraft draughtsmen at Warton Aerodrome, near Blackpool. Men with good aircraft drawing office experience are invited to apply for these interesting positions, which carry good salaries. Write, giving full details, quoting Ref. 120V, to Dept. C.P.S., 336-7 Strand, W.C.2. [2104

SENIOR and intermediate stressmen required by the de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch (nr. Bournemouth), Hants, for interesting structural analysis on supersonic aircraft. Past experience of aircraft stressing would be advantageous, but not regarded as essential for intermediate work. Minimum qualifications required are B.Sc., H.N.C. or equivalent. PLEASE write stating age, experience and training, and also salary required to the Chief Stressman. [2085

SENIOR draughtsman required with comprehensive experience of fuel and oil systems to initiate and take charge of section. Good welfare facilities including staff pension scheme.—Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Ltd., The Airport, Luton, Beds, stating age, experience and salary required. [2049

EXPERIENCED jet aircraft pilots with some knowledge of mathematics and aerodynamics, are invited to apply for an interesting position with aircraft manufacturers on non-flying duties. Salary commensurate with flying experience and technical qualifications. Please send details of experience, etc. to Box F249, LPE, 110 St. Martin's Lane, W.C.2. [2105

TECHNICAL illustrators (male, senior) required. Considerable practical experience of illustrating for sales brochures and descriptive manuals essential. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Hunting Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0592

HANDLEY PAGE (Reading), Ltd., The Aerodrome, Woodley, Reading, have vacancies in their design office for senior and intermediate draughtsmen and weightsmen. The work is on an interesting new project and there will be scope for rapid advancement to suitable applicants. — Please send full particulars of experience, etc., to the Personnel Officer. [0235

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

A. V. ROE AND COMPANY, Ltd., have vacancies in their newly formed electronics laboratory for technicians who would be occupied on work in connection with the development of electronic computing equipment for use in the design office. The electronics department is expanding and is likely to take in many diverse fields of development. Candidates should possess a degree in physics or electrical engineering and preference will be given to applicants who have had some practical experience. Applications, stating full details of age, qualifications and experience should be addressed to the Labour Manager, A. V. Roe and Company, Ltd., Greengate, Middleton, Manchester. [2078

H. M. HOBSON LTD.

have vacancies in their Design Office as under:—

1 SENIOR DESIGNER with experience of fuel systems. Capable of taking control of fuel unit Section.

1 WEIGHT ESTIMATOR

1 MODIFICATION DRAUGHTSMAN

JUNIOR DESIGN DRAUGHTSMEN

DETAIL DRAUGHTSMEN

The work is of a progressive nature, connected with fuel systems for gas turbines, ram jets, and rocket motors, as well as hydraulic flying control equipment for aircraft and guided missiles.

Good Salaries offered

Out-of-pocket expenses paid to applicants attending interviews.

Apply, stating experience, age and salary required, to:—

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HOBSON WORKS
FORDHOUSES
WOLVERHAMPTON, STAFFS

YOUNG ENGINEER

(23-26)

WITH B.Sc. or H.N.C.

to undertake development work on aircraft wheel and brake design. The work will include the analysis and correlation of results obtained from laboratory and flight test units. A knowledge of instrumentation would be advantageous.

Please write, giving full details, to:

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A VACANCY exists in a newly-equipped aerodynamics laboratory for an aerodynamicist, a physicist and a mathematician to work on problems at supersonic air speeds over a wide range of Reynolds numbers.—Please write, quoting Ref. ACJF to Box 5365. [2091

DRAUGHTSMAN required for work on aircraft components. Experience in the aircraft industry desirable, but not essential; good mechanical engineering draughtsman will be considered. Capable of working with the minimum of supervision. Write, giving particulars of age, experience and technical qualifications, to: King Aircraft Corporation, Fifth Street, Montrose Avenue, Hillington, Glasgow, S.W.2. [1933

ARMSTRONG SIDDELEY MOTORS, Coventry, have vacancies for a number of designers and senior and junior draughtsmen. Although gas turbine experience is most advantageous it is not necessarily essential as training will be given in this specialized work to suitably qualified draughtsmen.—Apply, in detail, to Reference F.103, Personnel Manager, Armstrong Siddeley Motors, Coventry. [0200

AIRFRAME stressmen are required for a design office in the south of England and salaries of £800 to £1,000 per annum are offered to applicants with six to 10 years' experience, and to those with three to five years' experience, £13 to £15 per week. Please send particulars of experience, qualifications and age, stating whether married, to Box AC88922, Samson Clarks, 57-61 Mortimer Street, W.1. [0236

CYPRUS AIRWAYS, Ltd., has an immediate vacancy for the position of commercial manager. Appropriate civil aviation experience is essential. Basic salary is in the scale of £1,350 x £50 to £1,750 per annum. In addition, certain cash allowances are payable, and furnished accommodation is provided at nominal cost. The successful applicant will be required to reside in Cyprus, and previous knowledge of Middle East conditions is desirable.

APPLICATIONS will be treated in the strictest confidence and should be sent by Airmail to the Secretary, Cyprus Airways, Ltd., 18 Homer Avenue, Nicosia, Cyprus, so as to reach him not later than June 21st, 1954. [2126

CHECKER for gas turbine drawing office. A qualified draughtsman is required to undertake the duties of checker in the gas turbine drawing office. Applicants should have had a number of years experience on high grade mechanical design work, and hold at least the O.N.C. Important contracts are now being handled and the position offers a career of considerable interest. Pension scheme. Apply to the Employment Manager, Ruston and Hornsby, Ltd., Lincoln. 2109

DESIGN draughtsmen required by Royal Aircraft Establishment, Farnborough, for novel, interesting work on aircraft equipment, guided weapons and associated activities. At least three years' workshop experience required and O.N.C. or equivalent. Salary £420 (age 21) —£580 (age 28)—£670. Five-day week of 44 hours (including meal breaks). Payment for overtime. Paid sick leave. Twenty days annual holiday plus public holidays. Possibility of houses for successful applicants. Apply, stating age, quals., experience, to any Employment Exchange, quoting Order No. Aldershot 816. [2113

BRITISH OVERSEAS AIRWAYS CORPORATION have vacancies for aircraft draughtsmen at London Airport. An interesting programme embraces the development, modification, conversion and repair work. An excellent opportunity for good versatile men to gain further experience in relation to the operational side of the industry. Education to ordinary National Certificate standard. Knowledge of AP.970 or British Civil Airworthiness requirements desirable. Salary in accordance with A.E.S.D. rates of pay, based on age and experience, plus scheme of proficiency pay. Normal working hours 37½ (five-day week). Good pension, insurance and sickness entitlement schemes. Catering facilities.—Write, in first instance, to Staff Supt. (Recruitment), British Overseas Airways Corporation, London Airport, Bath Road, Hounslow, Middlesex. [2130

THE Engine Division of the Bristol Aeroplane Company Limited has vacancies at Bristol for technical assistant, age 25-35, for drawing up and issuing build instructions to the shops and general liaison with shops. Qualifications: Engineering apprenticeship up to H.N.C. standard and experience in shops or drawing office. Also technical engineer for home and outside duties in the Ramjet Development Department, age 25-35, with practical experience of aero engine testing, installation or flight development. Qualifications: H.N.C. or B.Sc. degree or Aircraft Maintenance Engineers Licences in categories C or D. Good working conditions, pension scheme and welfare facilities.—Applications, giving details of age, qualifications and experience, and quoting ED.1, should be sent to The Personnel Manager, The Bristol Aeroplane Company Limited, Engine Division, Filton House, Bristol. [2128

AIRCRAFT captains are urgently required to serve with subsidiary companies of B.O.A.C. in the Persian Gulf area. Because of the urgency of the vacancies it is imperative that applicants are available either immediately or within a very short period. The essential qualifications are an A.L.T.P. Licence with Dakota and/or Dove endorsements and recent command experience with Dakota aircraft. The gross emoluments comprise a basic salary and an attractive scale of allowances and are free of income tax. Furnished accommodation is provided, but in certain areas married accommodation is not at the moment available. A nominal charge is made for the provision of accommodation. Free medical service and insurance are arranged, and home leave at the rate of eight weeks for each year of service is granted. Applications should be addressed to Staff Manager, Subsidiaries, British Overseas Airways Corporation, Airways House, Great West Road, Brentford, Middlesex. [2114

SITUATIONS WANTED

PILOT (30) ex-F.A.A., 730 hrs. singles P.P.L. R/T, studying C.P.L. B.Sc., design experience. Interested any position in aviation.—Box 5699. [2118

WANTED

WANTED urgently: Jane's Aircraft, 1945-46, in good condition. Replies: G. H. Stone, Livingstone Ave., Pymble, Sydney, Australia. [2107

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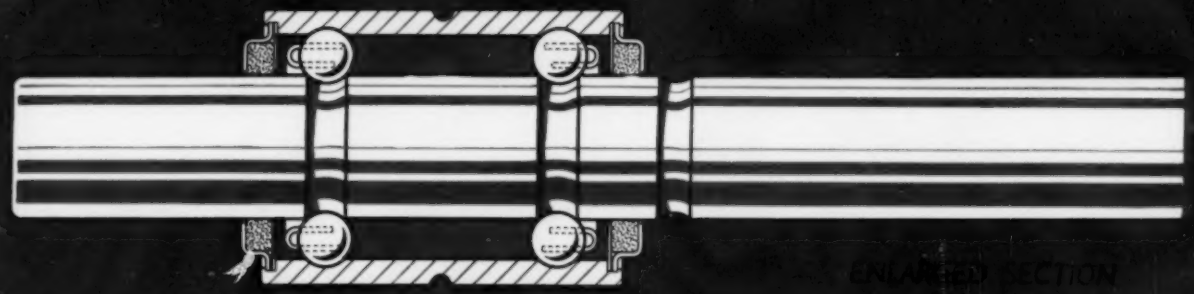

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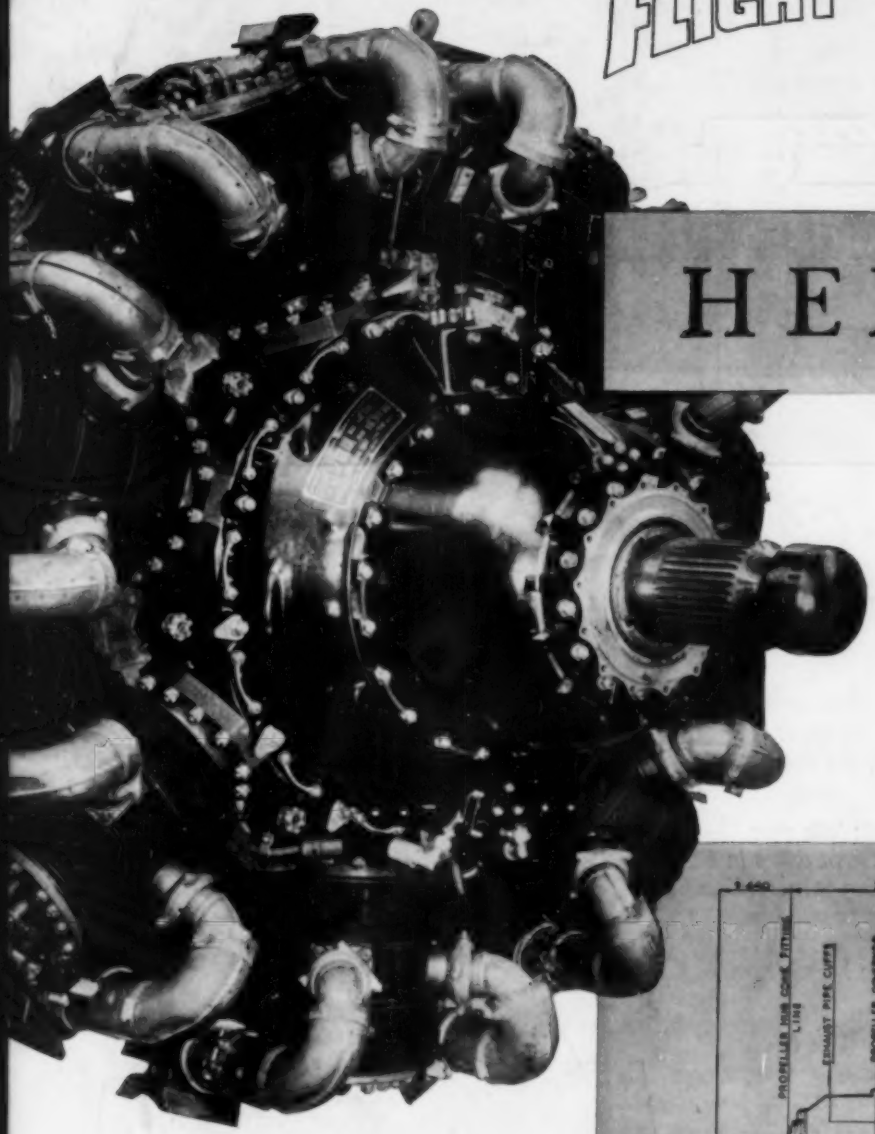

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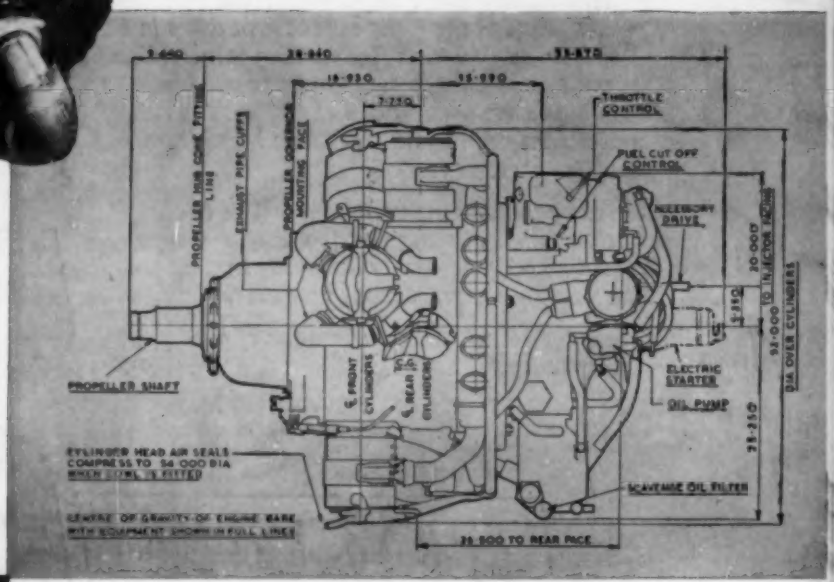

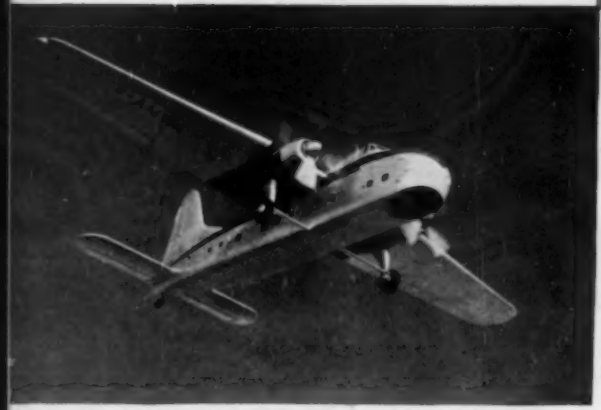

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